Regulatory Flexibility Screening Analysis for the **Proposed Loadings-Based Listing of Non-Wastewaters from the Production of Selected Organic Dyes, Pigments, and Food, Drug, and Cosmetic Colorants**

Final Report

Economics, Methods, and Risk Analysis Division
Office of Solid Waste
U.S. Environmental Protection Agency

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1.0 EXECUTIVE SUMMARY

This Regulatory Flexibility Screening Analysis (RFSA) was conducted to determine the potential impacts of the Agency's proposal to list as hazardous nonwastewater waste generated by the dye, pigment and FD&C colorant industries on small entities. The analysis was conducted per the requirement of the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).

This assessment presents a RFSA corresponding to the proposed rule to list organic dye, pigment, and FD&C manufacturing nonwastewaters (K181). For the purposes of the K181 listing, dyes and/or pigments production is defined to include manufacture of the following product classes: dyes, pigments, or FDA certified colors that are classified as azo, triarylmethane, or anthraquinone classes. Azo products include azo, monoazo, diazo, triazo, polyazo, azoic, benzidine, and pyrazolone products. Anthraquinone products include anthraquinone and perylene products. Triarylmethane products include both triarylmethane and triphenylmethane products. Organic dye, pigment or FD&C manufacturing nonwastewaters include but are not limited to: spent catalysts, spent adsorbents, equipment cleaning sludge, product standardization filter cake, filter aid, dust collector fines, recovery still bottoms, and wastewater treatment sludge. The proposed listed waste generated by the organic dye, pigment, and FD&C industries is defined as:

> Nonwastewaters from the production of dyes and/or pigments (including nonwastewaters commingled at the point of generation with nonwastewaters from other processes) that, at the point of generation, contain mass loadings of the following constituents: Aniline, o-Anisidine, 4-Chloroaniline, p-Cresidine, 2,4-Dimethylaniline, 1,2-Phenylenediamine, 1,3-Phenylenediamine, and Toluene-2,4-diamine that are equal to or greater than the acceptable conditional mass-loading levels, as determined on a calendar year basis. These wastes would not be hazardous if: (i) the nonwastewaters do not contain annual mass loadings of the following constituent: toluene-2,4-diamine, that are equal to or greater than the corresponding non-conditional mass-loading level; and (ii) the nonwastewaters are disposed in a Subtitle D landfill cell subject to the design criteria in §258.40 or in a Subtitle C landfill cell subject to either §264.301 or §265.301. This listing does not apply to wastes that are otherwise identified as hazardous under §§261.21-24 and 261.31-33 at the point of generation. Also, the listing does not apply to wastes generated before any annual mass loading is met.

In addition to the impacts on the dye, pigment and FD&C industries, the proposed waste listing may also result in impacts on other industries (i.e., non-dye, pigment and FD&C industries) that generate hazardous wastes containing one or more of the three constituents (o-anisidine, p-cresidine, and 2,4-dimethylaniline) that previously did not have specified Universal Treatment Standards (UTS)[1], and land disposal facilities which have disposed of the wastes considered in this rulemaking. Facilities in other impacted industries will have to conduct additional sampling

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[1] Four constituents (aniline, phenylenediamine (which is likely a mixture of all three isomers), 4-chloroaniline, and toluene-2,4-diamine already are on the 40 CFR Part 261 Appendix VIII list of constituents. Expanded scope facilities are already sampling for and treating these constituents to be in compliance with current regulations.

for these constituents and may need to treat wastes to UTS levels if current treatment methods are not meeting them already. Also, because of the proposed listing, leachate from the land disposal facilities which have disposed of the wastes considered in this rulemaking may be hazardous under the Derived-from Rule. When the leachate from this wastes mixes with leachate from other wastes disposed in these landfills the entire leachate quantity may be considered hazardous under the Mixture Rule.

We have identified a total of 37 organic dye, pigment, and FD&C facilities in operation in the U.S., which are owned by 29 different companies that are believed to be generating wastes of concern. Of these, a total of 15 companies (about 52 percent) been identified as "small businesses" using the Small Business Administration (SBA) definition of 750 employees based on corporate level data[2]. These 15 potentially affected small businesses operate a total of 16 different facilities. We have identified no small non profit organizations, small governmental jurisdictions, or small tribes that own and/or operate any dye, pigment and/or FD&C facilities.

Incremental costs to comply with new management, administrative, and sampling and analysis requirements for the proposed K181 listing range from \$0.05 to \$0.1 million per year. The incremental costs depend on the actual quantities of nonwastewaters generated at the four small facilities identified with wastes likely to contain constituents of concern (CoCs) and if the nonconditional mass-loading listing levels are exceeded for toluene-2,4-diamine for one small facility potentially generating waste containing this constituent.[3] Under a worst case scenario, incremental compliance costs range from \$0.08 to \$0.2 million per year if all 16 facilities have wastes containing CoCs and if the nonconditional mass-loading listing levels are exceeded for toluene-2,4-diamine for one facility identified having waste containing this constituent.[4]

Industry-average percent of annual *corporate* sales impacts for <u>the four small companies with wastes believed to contain CoCs</u> range between 0.02 to 0.03 percent, assuming a low nonwastewater generation rate and 0.04 to 0.06 percent, assuming a high nonwastewater rate. Overall, <u>15 small companies</u> (16 facilities), industry-average annual corporate sales impacts are estimated to average between 0.03 to 0.04 percent (assuming a low nonwastewater generation rate) and 0.04 to 0.08 percent (assuming a high nonwastewater generation rate). No company exceeds 0.53 percent of corporate sales when the high generation rate estimate is used and it is assumed the nonconditional mass-loading levels are exceeded.

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2 *Table of Small Business Size Standards - Matched to North American Industrial Classification System (NAICS) Codes*, Revised May 5, 2003, U.S. Small Business Administration (SBA).

3 Under a "Standard Listings Approach" where the waste will need to meet Universal Treatment Standards (i.e., combustion) under Land Disposal Restriction regulations, incremental compliance costs range from \$1.4 to \$1.5 million per year if only 4 facilities are impacted.

4 Under a "Standard Listings Approach" where the waste will need to meet Universal Treatment Standards (i.e., combustion) under Land Disposal Restriction regulations, incremental compliance costs range from \$1.5 to \$3.3 million per year if all 16 facilities are impacted.

Non-dye, pigment and FD&C facilities (referred to as "expanded scope facilities") may be indirectly impacted if they generate hazardous wastes containing one or more of the three toxic CoCs (o-anisidine, p-cresidine, and 2,4-dimethylaniline) being added to the list of constituents serving as the basis for classifying wastes as hazardous (40 CFR 261, Appendix VIII).[5] A total of 13 expanded scope facilities were identified but only one was identified as being owned by a small business, based on employment. No incremental compliance waste management costs were identified or assumed for the one small business. Current waste management procedures for organic wastes generated by this facility are assumed to effectively treat the newly added organic constituent. Incremental sampling and analysis costs are anticipated for this facility, with percent of corporate sales impacts estimated at approximately 0.08 percent.

As stated previously, a total of 15 of the 29 dye, pigment and FD&C companies impacted have been identified as small using the SBA definition of 750 employees. However our analysis suggests that the impacts on these small entities are modest. Impacts in excess of 1.0 percent of sales are not expected for any company, and in fact the highest impact is estimated at 0.53 percent of sales. Impacts on expanded scope small companies are projected to be less than 0.10 percent of annual gross revenues. Furthermore, no non business small entities are known to be impacted. Based on these findings, we do not believe that this rule, as proposed, will result in significant economic impacts on a substantial number of small entities.

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5 Four constituents (aniline, phenylenediamine (which is likely a mixture of all three isomers), 4-chloroaniline, and toluene-2,4-diamine already are on the 40 CFR Part 261 Appendix VIII list of constituents. Expanded scope facilities are already sampling for and treating these constituents to be in compliance with current regulations.

2.0 INTRODUCTION

This report presents an economic assessment corresponding to the proposed rule to list organic dye, pigment, and FD&C manufacturing nonwastewaters (K181). For the purposes of the K181 listing, dyes and/or pigments production is defined to include manufacture of the following product classes: dyes, pigments, or FDA certified colors that are classified as azo, triarylmethane, or anthraquinone classes. Azo products include azo, monoazo, diazo, triazo, polyazo, azoic, benzidine, and pyrazolone products. Anthraquinone products include anthraquinone and perylene products. Triarylmethane products include both triarylmethane and triphenylmethane products. Organic dye, pigment or FD&C manufacturing nonwastewaters include but are not limited to: spent catalysts, spent adsorbents, equipment cleaning sludge, product standardization filter cake, filter aid, dust collector fines, recovery still bottoms, and wastewater treatment sludge. K181 waste is defined as:

> Nonwastewaters from the production of dyes and/or pigments(including nonwastewaters commingled at the point of generation with nonwastewaters from other processes) that, at the point of generation, contain mass loadings of the following constituents: Aniline, o-Anisidine, 4-Chloroaniline, p-Cresidine, 2,4-Dimethylaniline, 1,2-Phenylenediamine, 1,3-Phenylenediamine, and Toluene-2,4-diamine that are equal to or greater than the acceptable conditional mass-loading levels, as determined on a calendar year basis. These wastes would not be hazardous if: (i) the nonwastewaters do not contain annual mass loadings of the following constituent: toluene-2,4-diamine, that are equal to or greater than the corresponding non-conditional mass-loading level; and (ii) the nonwastewaters are disposed in a Subtitle D landfill cell subject to the design criteria in §258.40 or in a Subtitle C landfill cell subject to either §264.301 or §265.301. This listing does not apply to wastes that are otherwise identified as hazardous under §§261.21-24 and 261.31-33 at the point of generation. Also, the listing does not apply to wastes generated before any annual mass loading is met.

EPA is proposing to list nonwastewaters from dye, pigment, and FD&C production as hazardous if they contain any of the constituents identified in Table 2-1 or 2-2 at a mass loading rate greater than or equal to the hazardous level set for that constituent.

Table 2-1. Conditional K181 Mass-Loading Listing Levels		
Constituent	**Chemical Abstracts No.**	**Mass Levels (kg/yr)**
Aniline	62-53-3	9,300
o-Anisidine	90-04-0	110
4-Chloroaniline	106-47-8	4,800
p-Cresidine	120-71-8	660
2,4-Dimethylaniline*	95-68-1	100
1,2-Phenylenediamine	95-54-5	710
1,3-Phenylenediamine	108-45-2	1,200
Toluene-2,4-diamine	95-80-7	0.99

* Synonyms include 2,4-xylidine and 1-amino-2,4-dimethylbenzene.
Note: These levels correspond to the K181 listing levels proposed to be added to 40 CFR 261.32(c)(1).

Table 2-2. Nonconditional K181 Mass-Loading Listing Levels		
Constituent	**Chemical Abstracts No.**	**Mass Level (kg/yr)**
Toluene-2,4-diamine	95-80-7	140

Note: This level corresponds to the K181 listing levels proposed to be added to 40 CFR 261.32(c)(2).

This RFSA was prepared to determine if there may be significant economic impacts to a substantial number of small entities potentially subject to the requirements of the proposed rulemaking. The analysis adheres to the Small Business Regulatory Enforcement Fairness Act (SBREFA), as signed into law on March 29, 1996, and related provisions of the Regulatory Flexibility Act (RFA). The determination of what entities are defined as small is based on the most recently available Small Business Administration (SBA) size standards guidelines.

Several analyses were conducted in completion of this RFSA including preparing or developing industry and small entity profiles, waste generation and management profiles, compliance costs, incremental impacts, and a determination of significant and substantial impacts. In this RFSA, compliance costs and incremental economic impacts are determined on a per unit basis (metric ton, gallon, etc.), facility, and aggregate (total industry) basis. In addition, determination of significant and substantial impacts are first defined (see Chapter 6) and then estimated on a per facility, and company basis to the extent data are available.

2.1 Background and Purpose of Rulemaking

In 1989, Environmental Defense (ED, formerly the Environmental Defense Fund) sued the Agency, in part, for failing to meet statutory deadlines of Section 3001(e)(2) of RCRA.[6] To resolve most of the issues of the case, ED and EPA entered into a consent decree which was approved by the court on June 18, 1991. The consent decree set out an extensive series of deadlines for promulgating RCRA rules and for completing certain studies and reports. The consent decree included deadlines for proposing and promulgating a final listing determination for wastes from the production of certain classes of dyes and pigments.

On December 22, 1994 (59 FR 66072), the Agency published the proposed action: *Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Dye and Pigment Industries; Hazardous Waste Listing Determination Policy; and CERCLA Hazardous Substance Designation and Reportable Quantities: Proposed Rules.* This action proposed listing, as hazardous, five wastes (proposed as K162 through K166) generated during the production of dyes and pigments due to evidence indicating unacceptable risks to human health and the environment resulting from existing management practices for these wastes. In the proposed rule, the Agency deferred action on three wastes.

On July 23, 1999 (64 FR 44444), EPA published a follow-up proposal: *Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Dye and Pigment Industries; Land Disposal Restrictions for Newly Identified Wastes; CERCLA Hazardous Substance Designation and Reportable Quantities: Proposed Rule.* This listing determination addressed the three deferred wastes, proposing to add two of these wastes (proposed as K167 and K168) to the list of hazardous wastes in 40 CFR 261.32. Unlike the 1994 proposed rule, the Agency included implementation conditions for the wastes proposed in the 1999 rule, such that the wastes would not be hazardous if they contained any of the constituents identified in the applicable list at a concentration greater than or equal to the risk-based concentration level proposed for that constituent.

Both proposals were supported by data from a questionnaire sent out to industry pursuant to RCRA section 3007. Some of the information submitted by some producers was claimed to be confidential business information (CBI). As a result of a consent order and a subsequent preliminary injunction entered in a case brought by some producers to prevent the disclosure of information claimed as CBI, EPA redacted some information from the preambles and background documents for these proposals. *Magruder Color Co., et al. v. EPA*, Civ. No.94-5768 (D.N.J.)

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[6] EDF v. Reilly; Civ. No. 89-0598 D.D.C.

In 2002 EPA began work on a new proposal based on a non-traditional "loadings-based"listing for dye and pigment wastes. Under this approach, EPA does not need to use any data submitted by the plaintiffs in the *Magruder* litigation.

Under the most recent amendment to the ED Consent Decree, EPA must propose a listing determination for the three specified classes of dye and pigment production wastes on or before November 10, 2003 . EPA must make a final listing decision by February 16, 2003.

This analysis evaluates a new approach for listing of dye, pigment and FD&C nonwastewaters (wastewaters are not proposed for listing). The approach taken for this proposed listing is a load-based risk approach. In a load-based risk approach, wastes are considered hazardous if they contain one or more of the specified constituents exceeding a mass loading (constituent concentration *times* quantity of the wastestream) standard. Those wastes exceeding the load-based standard will be required to meet land disposal restriction (LDR) treatment requirements (i.e., incineration) under what is referred to as the Standard Listing Approach. However, the Agency is proposing an alternative management approach, referred to as the Agency Preferred Approach, which allows the waste to be excluded from the listing contingent if it is managed in a municipal waste type (composite-lined) landfill and if it does not exceed a different loading limit for one constituent (Toluene 2,4-diamine).

This analysis estimates how facilities in the dye, pigment and FD&C industries may be affected by the load-based risk approach for listing of nonwastewaters under two approaches: the Standard Listing Approach and the Agency Preferred Approach, as mentioned above. Estimates of the cost and economic impacts of the regulation are determined nationwide, and on both a facility-specific and company basis.

2.2 Need For Regulatory Action

While waste produced by facilities in the dyes, pigments, and FD&C industries are already regulated to a certain extent under federal regulations (e.g., inorganic pigment, characteristic, and solvent wastes), certain waste streams generated by these facilities are not regulated and pose both human health and ecological risks. Current disposal practices for nonwastewaters have the potential to pollute soil and water. To date, the market and other private sector institutions have failed to fully address pollution issues associated with nonwastewaters.

First, because individuals not responsible for the pollution bear the costs in human health and ecological damages, no direct incentive exists for dye, pigment, and FD&C facilities to incur the additional costs for implementing pollution control measures. In this case, the private industry costs of production do not fully reflect the human health and environmental costs of management of these wastes. This situation, referred to as "environmental externality," represents a type of market failure discussed in OMB's Guidelines.[7] A non-regulatory approach, such as educational outreach programs, would be largely ineffective because the people who are made aware of the potential health risks (e.g., those people living near landfills where these wastes are disposed) have limited ability to reduce exposure without incurring significant costs.

Second, the parties harmed by the pollution of soil and water cannot feasibly obtain compensation from dye, pigment, and/or FD&C facilities through legal or other means due to the high transaction costs involved and the difficulty in establishing a causal relationship between the damage incurred and activity at the dye, pigment and/or FD&C facilities. Establishing a direct link between a specific facility and human health and other damages incurred may be especially difficult since under current practices many facilities dispose of wastes in landfills where it is co-mingled with many other wastes.

To internalize the environmental costs and to correct existing market distortions, government intervention is necessary. Therefore, EPA is proposing to list nonwastewaters from dye, pigment, and FD&C production as hazardous if they contain any of the constituents identified in Table 2-1 or 2-2 at a mass loading rate greater than or equal to the hazardous level set for that constituent.

Finally, this action is proposed under the authority of Sections 2002, 3001 (b)(1), 3001(e)(2), and 3007 of RCRA. Section 3001(e)(2) directs EPA to make a hazardous waste listing determination for "dyes and pigments."

2.3 Scope of Study and Data Sources

This study is an assessment of the potential impacts that will be borne by the dye, pigment, and FD&C industries for which the additional waste listing is being proposed and other industries that generate wastes containing the constituents with newly defined Universal Treatment Standards. Impacts to selected categories of the waste management industry are also examined. The dye, pigment, and FD&C industries produce literally hundreds of different products, typically in batch processes. Unfortunately, useful, unrestricted economic data for this industry are difficult to obtain. Primary data sources include the following (other sources are listed in the references in Section 7):

- The Chemical Economic Handbook published by SRI International,
- The U.S. International Trade Commission,
- EPA Toxics Release Inventory (TRI) database,
- EPA Hazardous Waste Report (Biennial Report) database,
- Dun and Bradstreet,

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7 Office of Management and Budget (OMB). January 1996. *Economic Analysis of Federal Regulations Under Executive Order 12866*, 3-5.

- Chemical Manufacturer and Product Database by ChemChannels.com, and
- Cornell University, Department of Environmental Health and Safety, Material Safety Data Sheets database.

2.4 Limitations of Analysis

The following is a non-exhaustive list of some of the limitations of this RFSA. Because of the need to rely on publicly available data, there are numerous analytical limitations related to several key issues. These limitations are briefly summarized below.

- Because of the need to rely on publicly available data, there are numerous analytical limitations related to several key issues. These limitations are briefly summarized below.

- This analysis relies, in part, on estimates of facility revenues for dye and pigment production which are derived from various sources. Estimates may not accurately reflect actual current revenues.

- This analysis does not capture all of the variables that may affect a generator's decisions about how to manage the proposed nonwastewaters.

- Limited publicly available data may have resulted in the underestimation or overestimation of potentially affected dye and pigment facilities identified with constituents of concern. If our sources did not identify all the constituents of concern used by all facilities, then we may have underestimated the number of affected facilities. On the other hand, we may have overestimated impacts if facilities do not (or no longer) use these chemicals, or if any constituents of concern present are below the mass loading limits.

- Data on nonwastewater generation are generally not available. We used a variety of sources to estimate waste quantities, including NPDES permit data, Office of Water data characterizing wastewater composition, generation and discharge rates for the organic chemical manufacturing industries, and other sources described more fully in section 4.3. Our methodology may not fully reflect current waste generation patterns and may result in uncertain cost estimates.

- Cost and economic impacts are based on total rather than incremental nonwastewater quantities due to the lack of facility specific data needed to determine loadings for constituents-of-concern. This limitation results in an overestimate of impacts.

2.5 Organization of Report

The remainder of this report is divided into four sections. Section 3 presents a profile of the organic dyes, pigments, and FD&C industries. This includes available economic profile data, such as products manufactured, profiles of facilities, market structure, an assessment of the market value of industry shipments, and product imports and exports.

Section 4 presents waste generation and management estimates. This Section also includes nationwide unit and facility costs and prices used in the baseline and post-regulatory cost estimates. Section 5 documents the costs and economic impacts of the proposed listing. Section 6 presents the findings of the small entity impact analysis.

3.0 DYES AND PIGMENTS INDUSTRIES PROFILE

The organic dye, pigment and FD&C industries produce dyes and pigments for a wide variety of intermediate and end users including the automotive, textile, printing, plastics, food, and drug manufacturers. This chapter profiles the characteristics of the organic dye, pigment and FD&C industries.

Organic dye and pigment manufacturing industries are classified under the North American Industry Classification System (NAICS) 325132. Food, drug and cosmetics colorant manufacturers are included in several NAICS industries, including: 311942--Spice and Extract Manufacturing; 311930--Flavoring Syrup and Concentrate Manufacturing; and 325199--All Other Basic Organic Chemical Manufacturing.

The U.S. market for organic dyes and pigments is forecasted to grow about 3 percent per year through 2005, rebounding from sluggish growth of only 0.6 percent from the 1995 through 2000 period. Much of the gains in market values are expected to result from a shift towards more expensive organic colorants.[8]

This chapter is made up of four individual sections: 1) organic dye industry overview, 2) organic pigment industry overview, 3) a brief overview of FD&C colorant manufacturers, and 4) an overview of the facilities that are expected to be impacted as the result of the proposed rulemaking.

3.1 Organic Dyes Industry Characteristics

This section presents an economic profile of the organic dyes industry which is classified under the North American Industry Classification System (NAICS) 3251321. The following subsections describe selected characteristics of the organic dye industry including products and processes, affected facilities, market structure, employment, and industry production and value.

3.1.1 Overview of Products and Processes

The Ecological and Toxicological Association of the Dyestuffs Manufacturing Industry (ETAD) defines dyes as “intensely colored or fluorescent organic substances which impart color to a substrate by selective absorption of light.” When applied, dyes penetrate the substrate in a soluble form, after which they may or may not become insoluble. The structure of dyes is temporarily altered during the application process and colors are imparted only by selective absorption.[9]

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8 Chemical Week. 7/25/01. “Pigments brighten; dyes fade.”

9 "Dyes and Dye Intermediates." Kirk-Othmer Encyclopedia of Chemical Technology, Fourth Edition. Volume 8. New York: John Wiley & Sons, Inc, 1993.

Dyes are used to color fabrics, leather, paper, ink, lacquers, varnishes, plastics, cosmetics, and some food items. Several thousand individual dyes of various colors and types are manufactured. This large number is attributable to the many different types of materials to which dyes are applied and the different conditions of service for which dyes are required.[10]

Synthetic dyes are derived in whole or in part from cyclic intermediates. Approximately two-thirds of the dyes consumed in the United States are consumed by the textile industry to dye fabrics; about one-sixth are used for coloring paper; and the rest are used primarily in the production of organic pigments and in the dyeing of leather and plastics.[11]

Commercial dyes are sold in several physical forms including granular, powders, liquid solutions, and pastes. The dyes contain colorata concentrations ranging from approximately one to more than 98 percent.[12]

Organic dyes are classified in several ways including their chemical structure or class, general dye chemistry, and application process. Chemical structure classifications include azos, triarylmethanes, diphenylmethanes, anthraquinones, stilbenes, methines, polymethines, xanthenes, phthalocyanines, and sulfurs. Common application process classes include acid, basic, direct, reactive, disperse, vat, and solvent. Using general dye chemistry, textile dyes are grouped into 14 categories or classes: acid dyes, direct (substantive dyes), azoic dyes, disperse dyes, sulfur dyes, fiber reactive dyes, basic dyes, oxidation dyes, mordant (chrome) dyes, developed dyes, vat dyes, pigments, optical/fluorescent brighteners, and solvent dyes[13].

The processes for developing azo and triarylmethane dyes, their primary uses, and limitations, when applicable, are briefly described below.

Azo Dyes

Azo dyes are formed by a diazotization reaction, which involves forming a diazonium ion from an aromatic amine using nitrous acid. A typical azo dye manufacturing process may include the following steps: slurry of raw materials, pre-reaction of raw materials, diazotization reaction, coupling reaction, filtration, drying, milling, standardizing, packaging, and shipping. The first

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10 "Chemical Economic Handbook Marketing Research Report - Dyes,", SRI International, 2000.

11 "Synthetic Organic Chemicals United States Production and Sales, 1991", USITC Publication 2607, February 1993.

12 "Chemical Economic Handbook Marketing Research Report - Dyes,", SRI International, 2000.

13 S. V. Kulkarni, C. D. Blackwell, A. L. Blackard, C. W. Stackhouse, and M. W. Alexander, U.S. Environmental Protection Agency, Air and Energy Engineering Research Laboratory, "Project Summary Textile Dyes and Dyeing Equipment: Classification, Properties, and Environmental Aspects," EPA/600/S2-85/010, April 1985.

three steps, slurrying, pre-reaction, and the diazotization reaction, can occur in the same reaction vessel. In this vessel, raw materials, water, and ice (for temperature control) are added, and the solution is agitated. The coupling reaction is conducted under controlled pH. The product stream is pumped to a large plate and frame filter press where it is isolated and collected as filter press cake. The product filter press cake is transferred to containers and may be either sold in this wet form or further processed. Further processing includes drying and pulverizing into a fine powder.[14]

Azo dyes produce a range of colors with excellent fastness properties. Azos are used essentially for all organic dye applications including natural and synthetic substrates. Historically azo dyes have been one of the most important dyes, accounting for as much as 35 percent of total dye production in 1972, for example.[15] Azo dyes form the largest single class of synthetic dyes, and they include more than 1,000 individual products.[16]

Triarylmethane Dyes

Chemically, triarylmethane dyes are derivatives of the colorless compounds triphenylmethane and diphenylnaphthylmethane. Primary, secondary or tertiary amino or hydroxyl groups in para positions to the methane carbon atom provide the color. Additional substituents present may include carboxyl, sulfonic acid or halogen groups. Possible hues include reds, violets, blues and greens. Several preparation methods exist for triarylmethane dyes. For example, with the aldehyde method, the central carbon atom in the triarylmethane structure is derived from the aromatic aldehyde. Malachite green is prepared by reacting benzaldehyde with dimethylaniline in acidic conditions at 100˚C. The reaction is made alkaline and the excess dimethylaniline is removed. The resultant leuco base is oxidized and lead salt is precipitated. Acidification produces the dye, which can be isolated as a chloride oxalate or a zinc chloride double salt.[17]

Triarylmethane dyes possess brilliant hue and have high tinctorial strength. They are inexpensive and may be applied to a wide variety of substrates. However, they have poor fastness properties.

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14 Austin, George T, *Shreve's Chemical Process Industries*, 5th edition, McGray-Hill Book Company, 1984; "Dye Manufacturing," Pollution Prevention Abatement Handbook, World Bank Group, effective July 1998, and "Pollution Prevention and Abatement Guidelines for Dye Manufacturing Industry," http://www.cleantechindia.com/bishhtml/2102.101.htm

15 USITC. 1974. Synthetic Organic Chemicals, U.S. Production and Sales.

16 ETAD. 12/15/1995. "Comments of the United States Dye Manufacturers Operating Committee of the Ecological and Toxicological Association of Dyes and Organic Pigments Manufacturers (ETAD)." EPA Docket DPLP-00027.

17 Ishikawa, Yosuke with Todd Esker and Andreas E. Leder. SRI International, The Chemical Economics Handbook, 2000. *CEH Marketing Research Report - Dyes.*

They are used to color acrylic fibers, paper and inks.[18]

3.1.2 Profile of Industry Facilities - Organic Dyes

A 1997 census report[19], the most recent census data available, provides some limited information on the organic dye industry. In 1997, there reportedly were 37 establishments listed under NAICS Code 3251321, Synthetic Organic Dyes. An estimated 3,500 individuals were employed by the industry and total industry wages were approximately $160 million.[20]

3.1.3 Industry Production and Value

The data in Table 3-1, shows that from 1997 through 1999, annual dye production has fluctuated from approximately 178.0 to 183.5 thousand tons. Production is projected to increase to 185.5 thousand tons in 2005.

Table 3-1. Total U.S. Production for Synthetic Organic Dyes

Year	Production (thousands of U.S. tons)
1997	183.5 *
1998	178.0 *
1999	179.0 **
2003	183.5 **
2004	184.5 **
2005	185.5 **

* Source: Ishikawa, Yosuke with Todd Esker and Andreas E. Leder. SRI International, The Chemical Economics Handbook, 2000. CEH Marketing Research Report - Dyes.
** Estimated from: Ishikawa, Yosuke with Todd Esker and Andreas E. Leder. SRI International, The Chemical Economics Handbook, 2000. CEH Marketing Research Report - Dyes. (Supply and Demand by Region: United States, page 2. 1995 through 1998 annual average growth of 0.6 percent. Projected from 355.9 million pounds in 1998 base year.)

Table 3-2 shows the weighted prices for organic dyes from 1998 to 2002. From 1998 to 2002,

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18 Ibid.

19 Synthetic Organic Dye and Pigment Manufacturing, Manufacturers-Industry Series, Census Bureau, Department of Commerce 1997.

20 Ibid.

the weighted average price for synthetic organic dyes steadily declined by 28 percent from $8,095 per ton to $5,870 per ton.

Table 3-2. Total U.S. Weighted Average Prices for Synthetic Organic Dyes	
Year	Price (Dollars/ton)
1998	8,095
1999	7,954
2000	7,119
2001	6,310
2002	5,870

Source: Based on USITC export price and quantity data for organic dyes included in HTS 320411 through 320416, and 320419.

Table 3-3 focuses on the distribution, production and sales by facility size for dyes, based on Census of Manufacturers data. The Census identified 37 dye facilities, plus an additional 32 facilities which manufactured dyes or pigments, or both which accounted for only 2.5 percent of total industry production.

Table 3-3. Dye Facility Size Distribution, Production and Sales*				
Employment Per Facility	Number of Facilities	Value of Shipments (Million Dollars)	Aggregate Estimated Production (1000 U.S. tons)	Average Sales/ Facility_ (Million Dollars)
1-19	8	32.3	5.0	$4.0
20-99	15	183.8	28.3	$12.3
>100	14	784.8	120.7	$56.1
Total	37	1000.9	154.0	$27.1

Source: Synthetic Organic Dye and Pigment Manufacturing, Manufacturers-Industry Series, Census Bureau, Department of Commerce 1997.
*Estimates derived from 1997 Census of Manufacturers for Synthetic Organic Dye and Pigment Manufacturing. Census only reports number of dye facilities and total value of dye shipments. Of the 112 facilities reported in the synthetic dyes and pigments industries, only 80 (37 dye and 43 pigment) were classified; the remaining 32 facilities were not specified by kind. These very small facilities accounted for approximately 2.5% of total industry shipments.

3.1.4 Domestic Industry Market and Trends

The late 1990's were difficult for the U.S. dye industry, primarily because of weakness in the textile industry, which accounts for 60 percent of U.S. dye consumption. Also contributing to decreases in textile dye consumption were increased imports of finished textile imports. Many countries in Asia, like China, India and Indonesia have significantly lower labor and environmental costs than the U.S. In addition, the global currency crisis in 1998-1999, which led Asian countries to increase exports, resulted in the sharp fall of dye and textile prices.[21]

In 2000, it was reported that U.S.-owned companies accounted for 25 percent of all U.S.-based operations, while European-owned U.S. subsidiaries held the remaining 75 percent.[22] Currently, the majority of the U.S. dye business is controlled by European-owned companies in the U.S..

Due to declining prices, some U.S. synthetic organic dye manufacturing companies have been forced to cease operation at certain manufacturing plants. It is expected that other producers may eventually move operations to Mexico, or supply Mexican mills with presscake synthesized from crude dye imported into the U.S. and then sent to Mexico for application to textiles.

As a result of reduced demand, import pressures and increasing environmental costs, some U.S.-based operations have discontinued operations in recent years as noted above, while others have switched to importing crude dyes and then conducted the finishing and formulating in the United States. In recent years, there has also been some increase in the number of small, low-cost entrepreneurial dye finishers and formulators who have begun to carve out market shares which were once held by the major companies.

3.1.5 Global Industry Trends

In 1998, global consumption of dyes was believed to have dropped by almost 15 percent, from the 1997 levels, as a result of the financial crisis in Asia, changing fashion styles and other factors. From 1998 to 1999, production and consumption of dyes also decreased in the United States, Western Europe and Japan. [23]

Consumption of dyes is dependent on several factors. The primary long term factor is the demand for textiles, leather and colored paper. Since textiles are the largest end-use market for dyes, their consumption depends directly on population growth and consumer spending levels. Fashion is the primary short term factor, which influences the types of colors used. Another lesser but also important factor is the substitutability of organic pigments for dyes.

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21 Ibid.

22 "Chemical Economic Handbook Marketing Research Report - Dyes", SRI International, 2000.

23 Ibid.

The dye industry has also experienced a significant amount of oversupply in the last few years, resulting in severe pressure on prices, which has led to most dye producers suffering significant losses and major restructuring, especially in the United States and Western Europe.[24]

In terms of demand, it is expected that there will be a significant and sustainable growth of the dye market primarily in Asia. For other international dye producers, less growth is expected due to the fall in prices from the Asian crisis in 1998 to 1999, as well as import pressures from Asian countries. Another factor which has affected these producers from more industrialized countries is the rising cost of disposing of relatively high quantities of hazardous organic wastes generated during production.

Table 3-4 represents the total value and quantity for organic dye and pigment imports in the U.S. from 1998 to 2002. The value of organic dye and pigment imports steadily declined by almost 30 percent from 1998 to 2001, when it reached $682.8 million. However, in 2002 the value increased to $716.3 million. In terms of quantity, the organic dye and pigment imports experienced an increase from 1998 through 2000, then a slight decline in 2001, followed by a rebound in 2002.

Table 3-4. Total U.S. Value and Quantity of Imports of Organic Dyes and Pigments

Product	1998	1999	2000	2001	2002
Total Value (million dollars)	970.0	939.7	843.9	682.8	716.3
Total Quantity (1,000 U.S. tons)	106.7	109.1	110.2	100.5	112.2
Unit Value (dollars/ton)	9,091	8,613	7,658	6,794	6,384

Source: Compiled from tariff and trade data from the U.S. Department of Commerce, the U.S. Treasury, and the U.S. International Trade Commission.

Table 3-5, shows the total value and quantity for organic dye and pigment exports in the U.S. from 1998 to 2002. The annual value for organic dye and pigment exports has steadily declined over the five year period, from $699.3 million to $586 million. The production values for organic dye and pigment exports peaked at 113,000 tons in 2000, and then continued to decrease to about 85,000 tons in 2002.

24 Ibid.

Table 3-5. Total U.S. Value and Quantity of Exports of Organic Dyes And Pigments					
Product	1998	1999	2000	2001	2002
Total Value (million dollars)	699.3	682.5	726.6	632.5	586.0
Total Quantity (1,000 U.S. tons)	94.0	99.5	113.0	97.3	84.6
Unit Value (dollars/ton)	7,439	6,859	6,430	6,501	6,927
Source: Compiled from tariff and trade data from the U.S. Department of Commerce, the U.S. Treasury, and the U.S. International Trade Commission.					

3.2 Organic Pigments Industry Characteristics

This section presents an economic profile of the organic pigment industry which is classified under the North American Industry Classification System (NAICS) 325132, Synthetic Organic Dye and Pigment Manufacturing. The NAICS code for synthetic organic pigments specifically is 3251324. The following subsections describe selected characteristics of the organic pigments industry including products, affected facilities, market structure, and industry production and value.

3.2.1 Overview of Products

The Color Pigment Manufacturers' Association (CPMA) defines pigments as "colored, black, white, or fluorescent particulate organic or inorganic solids, which usually are insoluble in, and essentially physically and chemically unaffected by, the vehicle or substrate in which they are incorporated." According to the CPMA, the primary difference between pigments and dyes is that pigments are insoluble in the substrate during the application process while dyes are soluble in the substrate. Pigments retain a crystalline or particulate structure and impart color by selective absorption or by scattering of light.[25]

The approximate percentage of synthetic organic pigments by use during 1991-1995 was as follows: inks (60%), paints and coatings (25%), plastics (10%), and other (5%). Pigments are used primarily in printing inks. In 2002, the distribution was as follows: inks (67%), paints and coatings (16%), plastics (10%), and other (7%). There are fewer pigments produced than dyes.

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[25] Dr. Joy Kunjappu, Ph.D., D.Sc., Chemical & Consulting, New York, "Pigments in Ink," posted on Paint & Coating Industry's (PCI) website on August, 28, 2000, http://www.pcimag.com/pci/cda/articleinformation/features/bnp__features__item/0,1846,9176,00.html/0,1848,19342,00.html.

However, pigment batches generally are larger in size.[26] [27]

Organic pigments are derived in whole or in part from benzenoid chemicals and colors and are described as being toners or lakes. These pigments essentially are the same in final form, but differ in their preparation method. A lake is an organic pigment produced by the interaction of a soluble dye, a precipitant, and absorptive inorganic substrate. A toner is an insoluble colorant produced as a powder; some toners are extended by the inclusion of a solid diluent.

3.2.2 Profile of Industry Facilities - Organic Pigments

The 1997 Census of Manufacturers,[28] the most recent census data available, provides some information on the organic pigments industry. In 1992, there reportedly were 43 establishments listed under NAICS Code 3251324, Synthetic Organic Pigments, Lakes, and Toners. An estimated 4,600 individuals were employed by the industry and total industry wages were approximately $208 million.[29]

3.2.3 Global Industry Trends

In 1999, the world market value for colored pigments, both inorganic and organic, reached $7.5 billion, of which $4.9 billion was organic pigments[30]. Globally, Western Europe produced 37 percent of the world market share, followed by North America accounting for 28 percent, and Asia with 25 percent of the total market. North America and Europe are the largest markets for organic pigments. Along with Japan, these three regions account for the dominant share of high-performance pigments, which are the most profitable of organic pigments.

Figure 3-1 shows the world market value of organic pigments by chemical class for 1999. Azo pigments are the largest group of organic pigments, accounting for 59 percent of the world market value share in 1999, followed by phthalocyanines, with a share of 29 percent, and high-

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26 "Industry and Trade Summary Synthetic Organic Pigments," USITC Publication 3021, February 1997.

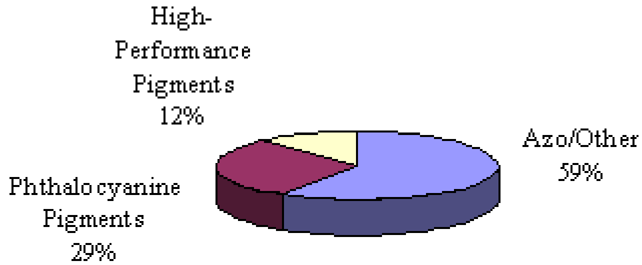
27 "The Organic Pigment Industry: Where its Been and Where its Going," Ink World, May 2003.

28 Synthetic Organic Dye and Pigment Manufacturing, Manufacturers-Industry Series, Census Bureau, Department of Commerce 1997.

29 Ibid.

30 "Chemical Economic Handbook Marketing Research Report - Pigments," SRI International, 2001.

Figure 3-1. World Market Value of Organic Pigments by Chemical Class, 1999



Total Market Value - $4.9 billion

Source: "Chemical Economic Handbook Marketing Research Report - Pigments," SRI International, 2001.

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performance pigments accounting for the remaining 12 percent.

The global pigment industry, particularly, the organic pigment business, is expected to change steadily during the next decade. The industry will continue to experience challenges due to the rapid globalization of the business, environmental pressures, the maturing markets in some applications and regions, and the continued oversupply of phthalocyanine and azo pigments, which keeps prices depressed.

The growth in the printing inks, paints and coatings, and plastics industries, is primarily what drives the consumption of pigments. During 1999 to 2004, color organic pigment consumption in North America, Western Europe and Asia, will grow 2.5 to 3.0 percent per year by volume. The growth rate will be highest in plastic applications, where the development and use of speciality high-performance organic products continues to increase.[31]

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[31] "Chemical Economic Handbook Marketing Research Report - Pigments," SRI International, 2001.

The total value and quantity of imports and exports of organic dyes and pigments were presented previously in Tables 3-4 and 3-5. The value of organic dye and pigment imports fell from 1998 to 2002, as did export values. Production levels for organic dye and pigment imports increased from 1998 to 2002, while their exports declined over the same time period.

In terms of capacity, organic pigment plant demographics have shown that an increase in global production capacity has far out-paced the growth of consumption. Table 3-6 shows the relationship of consumption versus capacity for the last five years. Table 3-7 shows the organic pigment usage by industry for 2002. Of all the industries, the printing ink industry uses the highest amount of organic pigment, 143,000 metric tons, followed by coatings, and plastics.[32]

Table 3-6. Global Capacity Utilization for the Pigment Industry

	Capacity (1,000 Metric Tons)	Consumption (1,000 Metric Tons)	Excess Capacity (1,000 Metric Tons)	Capacity Utilization
1998	270	210	60	78%
1999	275	218	57	79%
2000	280	227	53	81%
2001	285	211	74	74%
2002	288	213	75	74%

Source: “The Organic Pigment Industry: Where its Been and Where its Going,” Ink World, May 2003.

32 “The Organic Pigment Industry: Where its Been and Where its Going,,” Ink World, May 2003.

Table 3-7. Organic Pigment Usage by Industry, 2002	
Industry	Usage (Metric Tons)
Printing Ink	143,000
Coatings	34,000
Plastics	21,000
Others	15,000
Total	213,000
Source: “The Organic Pigment Industry: Where its Been and Where its Going,” Ink World, May 2003.	

3.2.4 Domestic Industry Market and Trends

During the last decade, the color pigment industry underwent a period of restructuring in response to the globalization of pigment markets, competitive factors and the impacts of environmental regulations.

Many small producers were unable to compete with larger international firms, and were forced to either close down their plants or they were acquired by larger, mainly Western European or Japanese firms. Product lines were realigned towards more higher-value pigments, which were more profitable. [33]

During the past ten years, the organic pigments market has grown in volume, while at the same time plant closures and company merger have led to increased industry consolidation. Growth in organic pigment production is generally related to the overall economy and more directly to printing inks, which are the largest market segment. In the past two decades, growth in production has been concentrated in phthalocyanine pigments and the high-performance pigments, such as quinacridones and perylenes.

3.2.5 Industry Production and Value

The synthetic organic pigments industry is a mature, slow growth industry, whose products are purchased by intermediate industries according to specific requirements for a final product. Inks account for over half of total pigment sales followed by paints and coatings, and plastics. The highest growth rate in organic pigment production is expected in plastics applications, where

[33] Ibid.

development and use of specialty high performance organic products continues to increase.[34]

Due to its end-uses, pigments consumption generally is dependent on general business conditions. Coatings and plastics are purchased in large quantities by the housing and automobile industries, both highly cyclical industries. Colored inks are used in advertising, which to a lesser extent also is cyclical.

In recent years two developments have impacted the costs, production schedules, and competitiveness of the pigments industry in most of the world’s developed countries: 1) the cost and uncertain availability of chemical intermediates and 2) stricter environmental regulations.[35]

Sales of synthetic organic pigments in the U.S. may take place through one of three distribution channels, which are: 1) directly from producer or importer to pigment consumer, 2) indirectly through distributors, or 3) indirectly through other pigment manufacturers. Published list prices are available, however, prices fluctuate frequently based on supply and demand. Quantity discounts also reportedly influence pricing significantly. Table 3-8 provides the production values for the organic pigment industry from 1997, with projects through 2005.

U.S. production of organic pigments increased by 5 percent during 1997 to 1999, from 75,500 tons to 79,500 tons. Production is estimated to increase at an average annual rate of 2.7 percent through 2005.

Table 3-8. Total U.S. Production for Organic Color Pigments

Year	U.S. Production (1,000 U.S. Tons)
1997	75.5 *
1998	77.5 *
1999	79.5 **
2003	88.5 ***
2004	91.0 ***

34 Ibid.

35 Industry and Trade Summary Synthetic Organic Pigments,” USITC Publication 3021, February 1997.

Table 3-8. Total U.S. Production for Organic Color Pigments	
Year	U.S. Production (1,000 U.S. Tons)
2005	93.5 ***

* Source: Will, Raymond and Akihiro Kishi. SRI International, The Chemical Economics Handbook, 2001. CEH Marketing Research Report - Pigments. (See page 5: Supply and Demand by Region. Estimated at 2.7 percent average annual growth from base of 159.2 in 1999. Projected back to 1997 - 1998, and through 2005.)
** Source: Will, Raymond and Akihiro Kishi. SRI International, The Chemical Economics Handbook, 2001. CEH Marketing Research Report - Pigments. (See page 3 of World Production and Demand Summary).
*** Estimated from: Will, Raymond and Akihiro Kishi. SRI International, The Chemical Economics Handbook, 2001. CEH Marketing Research Report - Pigments. (See page 5: Supply and Demand by Region. Estimated at 2.7 percent average annual growth from base of 159.2 in 1999. Projected back to 1997 - 1998, and through 2005.)

Table 3-9, shows the average per unit values for organic pigments, from 1998 to 2002. During this time period, prices fell by 16 percent from 1998 to 2000, however, were on the rise from 2001 to 2002 and increased by 6 percent.

Table 3-9. Average Per-unit Values for Organic Color Pigments	
Year	Price (dollars/ton)
1998	7,621
1999	6,931
2000	6,416
2001	6,450
2002	6,853

Source: Based on USITC export price and quantity data for organic pigments and color lakes included in HTS 320417 and 320500.

Table 3-10 presents 1997 Census of Manufacturing data depicting value of shipments by facility employment. The Census identified 43 pigment facilities, plus an additional 32 facilities which manufactured dyes or pigments, or both which accounted for only 2.5 percent of total industry production.

Table 3-10. Pigment Facility Size Distribution, Production and Sales*				
Employment Per Facility	Number of Facilities	Value of Shipments (Million dollars)	Aggregate Estimated Production (1000 U.S. tons)	Average Sales/ Facility ($1,000)
1-19	10	47.4	2.6	$4,736
20-99	17	269.2	15.0	$15,834
>100	16	1,149.4	63.9	$71,835
Total	43	1,466.0	81.5	$34,093

Source: Synthetic Organic Dye and Pigment Manufacturing, Manufacturers-Industry Series, Census Bureau, Department of Commerce 1997.
*Estimates derived from 1997 Census of Manufacturers for Synthetic Organic Dye and Pigment Manufacturing. Census only reports number of dye facilities and total value of pigment shipments. Of the 112 facilities reported in the synthetic dyes and pigments industries, only 80 (37 dye and 43pigment) were classified; the remaining 32 facilities were not specified by kind.
These very small facilities accounted for approximately 2.5% of total industry shipments.

Chemical Intermediates

During the manufacturing process, certain advanced chemical intermediates are produced. These intermediates are critical to a specific class of pigments, have their own markets, and are traded worldwide. Industry experts have noted that these intermediates can account for as much as 60 percent of the cost of a pigment thus, making them a critical factor in determining a pigment's ultimate price.[36] During the 1980s several of the major manufacturers ceased production of many of the intermediates used in the production of pigments in part due to supply shortages, but also due to increased regulations in Western Europe, Japan and the United States.[37]

This shortage of pigment intermediates resulted in significant price increases in the pigments industry. In an attempt to counter price increases, many U.S. manufacturers as well as pigment manufacturers in other industrialized countries sought new intermediate supply sources in developing countries and/or temporary suspensions of U.S. duties on imported intermediates. It has been reported, however, that to date, developing countries do not have sufficient capacity to

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36 "Industry and Trade Summary Synthetic Organic Pigments," USITC Publication 3021, February 1997.

37 Ibid.

meet industry needs. As a result of these shortages chemical intermediate prices have increased on average about 20 percent since 1990.[38]

3.3 Food Drug and Cosmetic Colorant Industry Characteristics

FD&C colorants are dyes and pigments that have been certified or provisionally certified by the Food and Drug Administration (FDA) for use in food items, drugs, and/or cosmetics. Typically, FD&C colorants are azo, anthraquinone, or triarylmethane dyes with azo representing the largest category. These products are similar or identical to larger-volume dye products not used in food, drugs, and cosmetics.

Manufacturers of FD&C colorants are included in several NAICS industries, including: 325132--Synthetic Organic Dye and Pigment Manufacturing; 311942--Spice and Extract Manufacturing; 311930--Flavoring Syrup and Concentrate Manufacturing; and, 325199--All Other Basic Organic Chemical Manufacturing. FD&C colorant manufacturers are only a very small segment of these industry groupings and accordingly a Census of Manufacturers industry overview is not practical. However, specific FD&C manufacturers expected to be affect by this rule are included in the facility-specific overview presented in Section 3.4.

FD&C dyes chemically consist of azo, anthraquinone, carotenoid and triarylmethane compounds. These compounds are consumed in smaller volumes than the major application classes (i.e., acid, basic, direct, disperse, reactive, solvent and vat dyes and fluorescent brighteners).

3.4 Overview of Affected Facilities

The Small Business Administration (SBA) typically defines for-profit business entities as "small" based on their North American Industrial Classification System (NAICS) code, and total corporate employment and/or annual gross revenues. For the synthetic organic dye and pigment manufacturing industry (325132), small entities are defined as companies with less than 750 employees. Based on this definition, the Agency estimates that a total of 15 small companies manufacturing organic dyes, pigments and FD&C colorants may be affected by the proposed waste listing. These facilities are identified with salient statistics, including estimated sales volumes in Table 3-11.

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[38] Ibid.

Table 3-11. Overview of Small Companies Potentially Impacted by the Proposed Waste Listing			
Company and Facility Location	**Estimated Total Corporate Annual Revenues**	**Total Corporate Employment**	**Information Source**
	2003 dollars		
Abbey Color, Inc.	$5,075,000	24	Dun&Bradstreet (revenues), Freedonia = 20 (2000 data) (Dun&Bradstreet = 24)
AC&S, Incorporated	$10,150,000	70	Dun&Bradstreet (2002) (revenues and employment)
Apollo Colors	$63,532,000	230	Freedonia (2000 data) (revenues and employment)
Chemical Compounds, Inc.	$3,230,000	15	Freedonia (2000 data) (revenue and employment)
Dye Specialties (This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.)	$8,076,000	35	Freedonia (2000 data) (revenue and employment)
European Color, PLC.	$69,272,000	303	www.ecplc.com/cgi-bin/gfr?page=ecplc/frameset.html&main=CorporateProfile.shtml (revenue and employment)
Galaxie Chemical	$4,307,000	15	Freedonia (2000 data) (revenue and employment)
Industrial Color Company, Inc.	$5,384,000	35	Freedonia (2000 data) (revenue and employment)
Magruder Color Company	$121,142,000	500	Freedonia (2000 data) (revenue and employment)
Max Marx Color	$6,461,000	30	Freedonia (2000 data) (revenue and employment)
Nation Ford Chemical Company	$15,225,000	60	Dun & Bradstreet (2002) (revenue and employment)
Passaic Color and Chemical	$21,536,000	75	Freedonia (2000 data) (revenue and employment)
Rose Color	$5,583,000	30	Dun and Bradstreet (revenue and employment)
Synalloy Corporation	$95,245,000	472	Synalloy SEC form 10K for year 2001 (revenue and employment)
United Color Manufacturing, Inc.	$2,154,000	10	Freedonia (2000 data) (revenue and employment)

Note: Corporate revenues adjusted to 2003 based on GDP implicit price deflator (rounded to nearest $1,000)
Freedonia = The Freedonia Group, Inc. Private Companies Report 1222, Dyes and Pigments, January 2000.

4.0 HAZARDOUS WASTE GENERATION AND MANAGEMENT

Nonwastewaters generated during the production of dyes, pigments, and FD&C colorants are proposed for a contingent hazardous waste listing action under the Resource Conservation and Recovery Act (RCRA). This section presents estimates of the quantity of waste generated, current (baseline) management practices, compliance management practices available after listing, and the unit costs and prices for managing these wastes, focusing on the 16 facilities owned by the 15 small entity manufacturers (see Table 3-11). However because of the method used to estimate waste generation industry-wide, some sections contain information regarding the entire affected dyes, pigments and FD&C colorant industries, a total of 37 facilities.

Limited public information is available by which to characterize the industries' waste generation and management. To complete this assessment EPA relied upon previously completed studies of the dyes, pigments, and FD&C industries and their sales, waste generation and management.

4.1 Proposed Listed Waste

This rule proposes to list organic dye, pigment, and FD&C manufacturing waste nonwastewaters (K181). For the purposes of the K181 listing, dyes and/or pigments production is defined to include manufacture of the following product classes: dyes, pigments, or FDA certified colors that are classified as azo, triarylmethane, or anthraquinone classes. Azo products include azo, monoazo, diazo, triazo, polyazo, azoic, benzidine, and pyrazolone products. Anthraquinone products include anthraquinone and perylene products. Triarylmethane products include both triarylmethane and triphenylmethane products. Organic dye, pigment or FD&C manufacturing nonwastewaters include but are not limited to: spent catalysts, spent adsorbents, equipment cleaning sludge, product standardization filter cake, filter aid, dust collector fines, recovery still bottoms, and wastewater treatment sludge.

Azo dyes are typically formed by a diazotization reaction, which involves forming a diazonium ion from an aromatic amine using nitrous acid. A typical azo dye manufacturing process may include the following steps: slurry of raw materials, pre-reaction of raw materials, diazotization reaction, coupling reaction, filtration, drying, milling, standardizing, packaging, and shipping. The first three steps, slurrying, pre-reaction, and the diazotization reaction, occur in the same reaction vessel. This is referred to as a batch process operation. In this vessel, raw materials, water, and ice (for temperature control) are added, and the solution is agitated. The coupling reaction is conducted under controlled pH. The product stream is pumped to a large plate and frame filter press where it is isolated and collected as filter press cake. The filter cake is the product material. The filtration generates a large volume wastewater stream consisting of concentrated mother liquors and subsequent wash waters. The product filter press cake is transferred to containers and may be either sold in this wet form or further processed. Further processing includes drying and pulverizing into a fine powder. Drying may be performed via tray, conveyer belt, spray, or other drying techniques.[39]

Anthraquinone dyes are commonly formed by a Freidel-Crafts reaction in which phthalic anhydride and benzene are reacted in the presence of aluminum chloride to form o-benzoylbenzoic acid. Closure of the aromatic ring in the intermediate gives the corresponding anthraquinone. Substitutions on anthraquinone rings, which produce the final product, may include nitro-, halo-, sulfonic-, carboxylic, hydroxy, ether, and amino-groups. The general manufacturing process used in the production of anthraquinone dyes is similar to the process for azo dyes.[40]

Triarylmethane dyes are synthesized industrially using the benzaldehyde, ketone (Michler's ketone), and diphenylmethane methods. The choice of process is determined by the structure of the dye manufactured. The general manufacturing process used in the production of triarylmethane dyes is similar ro the process used for azo dyes.[41]

FD&Cs are a class of dyes. They would be produced in a similar manner to the dye manufacturing process described above.

The general process used in the manufacture of organic pigments (toners and lakes) is similar to the process used for dyes. However, pigments can be dispersed in an oil for use in offset inks or in polyethylene for use in plastics. The filter press cake is transported to a flusher, which is a mixer for blending in the oil or polyethylene and removing water from the wet filter cake.[42]

Some facilities recover spent solvents by distillation. Still bottoms and heavy ends must be discarded periodically.

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39 Austin, George T, Shreve's Chemical Process Industries, 5th edition, McGray-Hill Book Company, 1984; "Dye Manufacturing," Pollution Prevention Abatement Handbook, World Bank Group, effective July 1998, and "Pollution Prevention and Abatement Guidelines for Dye Manufacturing Industry," World Bank, May 9, 2002 (http://www.cleantechindia.com/eicimage/210602_24/Dye-GUIDELINE.htm).

40 U.S. EPA, Industrial Environmental Research Laboratory, Office of Research and Development, "Wastes from Manufacturer of Anthraquinone Dyes and Pigments," prepared by Julie E. Gwinn and David C. Bomberger, SRI International, July 31, 1983.

41 U.S. EPA, Industrial Environmental Research Laboratory, Office of Research and Development, "Wastes from Manufacturer of Diphenylmethane and Triarylmethane Dyes and Pigments," prepared by Julie E. Gwinn and David C. Bomberger, SRI International, July 31, 1983.

42 "Pigment in General", http://www.monokem.com/pigasgen.htm and Austin, George T, *Shreve's Chemical Process Industries*, 5th edition, McGray-Hill Book Company, 1984; "Dye Manufacturing," Pollution Prevention Abatement Handbook, World Bank Group, effective July 1998.

4.2 Population of Impacted Dye, Pigment and FD&C Facilities and Expanded Scope Facilities

EPA conducted research to identify which dye, pigment and FD&C facilities may be impacted by the proposed listing and which non-dye, pigment and FD&C facilities (referred to as "expanded scope facilities") generate hazardous wastes that contain one or more of the three toxic constituents o-anisidine, p-cresidine, and 2,4-dimethylaniline associated with these identified wastes being added to the list of constituents that serves as the basis for classifying wastes as hazardous (40 CFR 261, Appendix VIII).[43]

4.2.1 Dye, Pigment and FD&C Facilities

As noted previously, only limited information is available regarding how many of the dye and pigment manufacturing facilities generate the wastes considered in this listing. A determination regarding which facilities produced azo dyes and/or pigments was made as a result of meetings with the primary associations, including: Ecological and Toxicological Association of Dyes and Pigments Manufacturers (ETAD), and Color Pigments Manufacturers Association, Inc. (CPMA).

EPA estimates there are a total of 37 dye, pigment, and FD&C manufacturing facilities operating in the United States that may be impacted by the proposed rule (Appendix A). Of these 37 facilities, there are 18 potentially affected dye producers, 20 potentially affected pigment producers, and six FD&C producers (Appendix A).

The total synthetic organic dye and pigment industry revenues from the 1997 Census was adjusted to 2003 using a simple 3 percent annual adjustment factor. This number was increased by 10 percent to account for estimated FD&C revenues.[44] The total industry dye, pigment, and FD&C revenues were then apportioned among the 29 companies based on the gross corporate sales revenues, except for the very small companies where 97 percent of gross corporate revenues was assumed.[45] For multi-facility companies, the total dye, pigment and FD&C revenues were divided equally. However, when there was FD&C production only at one of the facilities in a multi-facility company, only ten percent of the total synthetic dye and pigment production revenues was assumed for that facility rather than equal portions. For example, if an impacted company had three facilities and two facilities manufacture pigments and only one facility

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43 Four constituents (aniline, phenylenediamine (which is likely a mixture of all three isomers), 4-chloroaniline, and toluene-2,4-diamine) already are on the 40 CFR Part 261 Appendix VIII list of constituents. Expanded scope facilities are already sampling for and treating these constituents to be in compliance with current regulations.

44 Approximate average proportion of annual gross revenues derived from FD&C production for companies that manufacture synthetic organic dyes, and/or organic pigments, plus FD&C.

45 Based on available data sources indicating estimated dye and pigment revenues as percent of total gross revenues for affected small companies.

manufactures FD&C, then the total synthetic dye, pigment and FD&C production revenue for that company was apportioned equally between the two pigment manufacturers (45 percent each) with the remaining 10 percent being assigned to the FD&C-only facility. The percent of ***affected*** production revenues is assumed to be 50 percent[46] for dye manufacturing, 90 percent[47] for pigment manufacturing, and 80 percent[48] for FD&C manufacturing.

We have identified the presence of one or more of the eight Constituents of Concern[49] (CoCs) at four of the 16 potentially affected small facilities (Table 4-1). This determination is based on the following sources: Toxics Release Inventory (TRI), National Hazardous Waste Constituent Survey (NHWCS), Colour Index, 2001 SRI Directory of Chemical Producers, public comments on prior proposed dye and pigment listings, and non-confidential business information (CBI) from the 3007 RCRA Questionnaire. We base our most likely impacted analytical scenario using these four facilities. Two[50] of these four facilities may generate wastes, as a result of manufacturing, that contain toluene-2,4-diamine. This constituent has a nonconditional listing mass-loading level (Table 2-2). However, one of these two facilities (Dye Specialties[51]) is not likely to exceed the mass-loading level because we estimate that this facility generates very small quantities of nonwastewaters (see Table 4-6).

A total of 15 of the 29 companies have been identified as small using the SBA definition of 750 employees at the corporate level. Table 4-1 and Appendix A identifies which facilities are small. Four of the small entities (in bold) generate wastes containing one or more of the eight

46 Estimate derived from the public outreach document: U.S. EPA Office of Solid Waste, *Regulatory Flexibility Screening Analysis - Proposed Listing as RCRA Hazardous Waste and Land Disposal Restrictions (LDRs) for Wastewaters and Wastewater Treatment Sludge from the Production of Azo Dyes and Pigments, and Still Bottoms from the Production of Triarylmethane Dyes and Pigments - Draft report*, November 9, 2000. [Note: No public comments were received challenging this estimate.]

47 Source: Public comment from the Color Pigments Manufacturers Association, Inc., January 4, 2001. Comment on page 3 states: In those facilities producing azo pigments this number is actually in excess of 80%." As a result of this comment an estimate of 90 percent was applied in this analysis.

48 EPA estimate.

49 Aniline, o-anisidine, 4-chloroaniline, p-cresidine, 2,4-dimethylaniline, 1,2-phenylenediamine, 1,3-phenylenediamine, and toluene-2,4-diamine.

50 A third facility, Abbey Color, Inc. was also identified as selling products that may use toluene-2,4-diamine in the manufacturing process. However, it is uncertain whether this is facility only repackages/reformulates this product, or actually manufactures this product. If included, the economic impacts to this company are estimated to be no more than 0.3 percent of gross annual revenues.

51 This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.

CoCs.

Table 4-1. Small Dye and Pigment Facilities with Identified Constituents of Concern	
Company and Facility Location	**Identified Constituents of Concern**
Abbey Color, Inc., Philadelphia, PA	2,4-dimethylaniline, toluene-2,4-diamine, 1,3-phenylenediamine, aniline, o-anisidine, p-Cresidine
AC&S, Incorporated, Nitro, WV	None
Apollo Colors, Rockdale, IL	None
Chemical Compounds, Inc., Newark, NJ	None
Dye Specialties, Jersey City, NJ (This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.)	toluene-2,4-diamine 1,3-phenylenediamine aniline
European Color, PLC., Fall River, MA (EC Pigments, Roma Colour)	None
Galaxie Chemical, Paterson, NJ	None
Industrial Color Company, Inc., Joliet, IL	None
Magruder Color Company, Cartaret, NJ (includes Uhlich)	None
Magruder Color Company, Elizabeth, NJ (includes Uhlich)	None
Max Marx Color, Irvington, NJ	None
Nation Ford Chemical Co., SC	aniline
Passaic Color and Chemical (Royce Associates, LP), Paterson, NJ	toluene-2,4-diamine, 2,4-dimethylaniline, o-anisidine, 1,2-phenylenediamine, 1,3-phenylenediamine, aniline,
Rose Color, Newark, NJ	None
Synalloy Corporation, Spartanburg, SC	None
United Color Manufacturing, Inc., Newton, PA	None

Note: Findings in this table reflect verified constituents based on available non CBI sources identified at the time of

Table 4-1. Small Dye and Pigment Facilities with Identified Constituents of Concern	
Company and Facility Location	**Identified Constituents of Concern**
this analysis. This list may not be fully comprehensive. Facilities in **bold** were identified with constituents of concern.	

4.2.2 Expanded Scope Facilities

Non-dye, pigment and FD&C facilities (i.e., expanded scope facilities) may be indirectly impacted if they generate wastes containing one or more of three constituents of concern (o-anisidine, p-cresidine, and 2,4-dimethylaniline).[52] These are constituents not currently on 40 CFR Part 261, Appendix VIII. Table 4-2 below presents a summary of the number of expanded scope facilities generating wastes that are likely to contain one of the three CoCs. One company was identified as small business, as defined by the SBA.

Table 4-2. Summary of Expanded Scope Facilities and Small Companies*

Constituent	Number of Facilities	Number of Small Companies	SIC Codes	NAICS Codes
2,4-Dimethylaniline	9	1	2865, 2869, 5169	32511, 325192, 42269
o-Anisidine	1	0	2869	32511, 325192
p-Cresidine	3	0	2865, 2869	32511, 32512, 325199
TOTALS	**13**	**1**		

* Expanded scope facilities were identified through a search of the following databases:
- EPA Toxics Release inventory database;
- Chemical Manufacturer and Product Database by ChemChannels.com; and
- Cornell University, Department of Environmental Health and Safety, Material Safety Data Sheets database that contains ~ 250,000 MSDS files derived from:
  - the U.S. Government Department of Defense MSDS database available for purchase from Solutions Software
  - data from siri.uvm.edu.
  - MSDS sheets maintained by Cornell University Environmental Health and Safety and other Cornell departments.

52 Four constituents (aniline, phenylenediamine (which is a mixture of all three isomers), 4-chloroaniline, and toluene-2,4-diamine) already are on the 40 CFR Part 261 Appendix VIII list of constituents. Expanded scope facilities are already sampling for and treating these constituents to be in compliance with current regulations.

4.3 Annual Waste Generation

Wastewater and wastewater treatment sludge quantities are estimated for the list of 16 small dye, pigment, and/or FD&C facilities operated by 15 companies. Wastewater quantities were estimated in order to derive wastewater treatment sludge quantity estimates.

- Two facilities were identified as direct dischargers to surface water from the EPA's 2003 Permit Compliance System (PCS) database. Their wastewater quantities were obtained from the PCS database. Average monthly flows were used to determine an average annual flow volume.

- A wastewater flow rate of 125,700 U.S. tons per year was provided by the Synalloy, Spartansburg facility in their response to EPA's *Surface Impoundment Study*.

- A wastewater flow rate of 136,985 U.S. tons per year for the Galaxie Chemical Corporation facility was provided in Galaxie's comment (EPA docket number #DPLP-00012) on the 1994 proposed listing.

- Wastewater generation was estimated for the remaining 12 small facilities based on revenue data compared to the statistical findings on indirect dischargers from the Specialty Organics category in the 1987 document: *Development Document for Effluent Limitations Guidelines, New Source Performance Standards, and Pretreatment Standards for the Organic Chemicals and the Plastics and Synthetic Fibers Point Source Category Report (OCPSF Effluent Guidelines).* The wastewater flow statistics (mean, median, standard deviation, and sample size) for the Specialty Organics Category as reported in the OCPSF Effluent Guidelines background document were used. The data in the OCPSF are from 1980 reported waste volumes. The sample included 90 plants where at least 70 percent of their production was related to the Specialty Organics subcategory (Table 4-3).

Table 4-3
Wastewater Flow Statistics for the Specialty Organics Category *
(gallons per day)

Number of Plants	Mean	Median	Standard Deviation
90	360,000	70,000	1,630,000

* Data obtained from Table V-10, page V-14, from the 1987 OCPSF Effluent Guidelines report

A log normal distribution of wastewater quantities was developed from these statistics. The log-normal distribution is widely used where, 1) values are positively skewed with most of the values near the lower limit; 2) the variable can increase without limits, but cannot fall below zero; and, 3) where the coefficient of variability (the ratio of the standard deviation to the mean) is greater than 30 percent. The wastewater flow statistics met these three criteria. The coefficient of variability for the wastewater flow data was 453 percent. The software program Crystal Ball was used to develop a distribution curve for the wastewater data. The Crystal Ball program uses a Monte Carlo technique to create a distribution of outcomes over thousands of iterations (50,000 in this case). From the distribution created by the Crystal Ball software, the wastewater quantities were determined for every fifth percentile (Table 4-4).

Based on the production revenue data obtained for each dye and pigment facility a corresponding production revenue percentile was assigned to each of the indirect dischargers. It was assumed that the quantity of product produced directly correlated with the quantity of wastewater generated. For example, if a facility's product production revenue was at the 90th percentile level it will generate wastewater at the 90th percentile level as well (Table 4-4).

Table 4-4
Percentile Distributions of Dye, Pigment and FD&C Production Revenues and Wastewater Generation

Percentile	Production Revenues (dollars/year)	Wastewater Generation (GPD)	Percentile	Production Revenues (dollars/year)	Wastewater Generation (GPD)
0%	$388,289	100	55%	$43,598,629	95,790
5%	$1,612,435	4,370	60%	$52,419,069	119,680
10%	$2,979,621	8,170	65%	$53,828,560	151,080
15%	$3,774,173	12,430	70%	$55,055,234	192,900
20%	$5,032,231	17,480	75%	$60,989,031	250,510
25%	$8,672,842	23,490	80%	$64,649,531	335,710
30%	$10,570,274	30,500	85%	$72,416,728	470,530
35%	$13,505,525	38,900	90%	$86,430,456	717,020
40%	$23,895,654	49,400	95%	$217,601,575	1,334,220
45%	$32,962,341	61,760	100%	$668,129,092	15,241,560
50%	$42,477,477	76,490			

Annual wastewater treatment sludge generation rates were estimated for all small facilities based on data from the 1987 OCPSF Effluent Guidelines report. The sludge generation rates were estimated based on wastewater characteristics reported, such as total suspended solids (TSS). It was assumed that activated sludge was the wastewater treatment method and that the sludge was dewatered on a belt filter press prior to disposal. The OCPSF report states that these are the primary wastewater treatment methods used in the Specialty Chemical industry.

The TSS values reported in the 1987 OCPSF Effluent Guidelines Report are presented in Table 4-5. The large standard deviations presented in this data, and the fact that the mean values are significantly greater than the median values, indicate that the mean values are upwardly skewed by a few large values in the population. Therefore, the median values are assumed to be more appropriate representation of the expected influent concentrations. The median TSS concentration of 194 mg/L is used to calculate the sludge generation rates at direct dischargers and the median TSS concentration of 151 mg/L is used to calculate the sludge generation rates at indirect dischargers. PCS data were used to identify facilities that have NPDES discharge permit (i.e., direct dischargers). All other facilities are assumed to discharge to a POTW (i.e., indirect dischargers) given they are not listed in the PCS database. In addition, a high sludge generation rate was developed for each facility using the mean TSS concentrations of 404 mg/L and 465 mg/L for direct and indirect dischargers respectively.

Table 4-5
Raw Wastewater Total
Suspended Solids Concentrations *
(mg/L)

Discharge Pattern	Number of Plants	Mean	Median	Standard Deviation
Direct Dischargers	10	404	194	528
Indirect Dischargers	40	465	151	1245

* Data obtained from table V-34 from the OCPSF Effluent Guidelines report

The typical solids content of waste activated sludge from a secondary clarifier is one to four percent.[53] The typical dewatering performance from a belt filter press of waste activated sludge is a cake solid of 12 percent to 20 percent.[54] The typical solids concentration from belt filter press filtration with chemicals is 15 percent to 30 percent with a typical value of 22 percent.[55] The typical level of polymer addition to waste activated sludge when going to a belt filter press for dewatering is eight to 20 pounds of dry polymer added per ton of dry solids.[56]

As described above, influent wastewater average TSS concentrations of 151 mg/L to 465 mg/L for indirect dischargers and 194 mg/L to 404 mg/L for direct dischargers are assumed prior to entering the activated sludge wastewater treatment system. According to the OCPSF Effluent Guidelines, activated sludge treatment results in a median removal efficiency of 81 percent for TSS.[57] It is assumed that the direct dischargers will treat their waste to a higher level than indirect dischargers. This can be accomplished through process modifications to improve the efficiency of the biological treatment system, the secondary clarification system, or by installing tertiary treatment such as polishing ponds. Simple modifications to the secondary clarification systems, such as installation of flow-modifying structures and the addition of a stop gate prior to the clarifier, were shown to result in a 13 to 31 percent reduction in effluent TSS levels.[58] Based on these data, it is assumed that indirect dischargers would modify their treatment systems to reduce the effluent TSS levels by an average of 20 percent. Therefore, 81 percent of the TSS would be removed from the wastewater by the indirect dischargers and 85 percent of the TSS would be removed by the direct dischargers.

Waste activated sludge is estimated to contain two percent solids before entering the belt filter press. Twenty (20) pounds of dry polymer per ton of dry solids is assumed to be added to the waste activated sludge to improve it's dewatering characteristics. The addition of this polymer will increase the dry sludge by one percent. The belt filter press is assumed to dewater the sludge to 20 percent solids. Based on the assumed influent TSS concentrations, the treatment removal efficiencies, and the dewatered sludge characteristics, high and low sludge quantities are estimated for each of the 37 facilities. For indirect dischargers, wastewater to sludge generation ratios were determined to be 1,621 and 526 for low and high sludge generation amounts, respectively. For direct dischargers, wastewater and sludge generation ratios were determined to

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53 *Wastewater Engineering- Treatment, Disposal, and Reuse,* Metcalf and Eddy, Inc. Third Edition, 1991.

54 Ibid.

55 Ibid.

56 Ibid.

57 OCPSF Effluent Guidelines, page VII-64.

58 OCPSF Effluent Guidelines, page VII-78.

be 1,202 and 577 for low and high sludge generation amounts, respectively. The estimated sludge quantities are presented in Table 4-6. The total high and low sludge quantity estimates presented in this table were used in the cost and economic impact analysis. We were not able to estimate incremental nonwastewater quantities above loading limits.

Table 4-6. Estimated Wastewater and Sludge Quantities									
Company and Facility Location	**Estimated Total Annual Revenues from Impacted Dye, Pigment, and FD&C Production**	**Estimated Total Annual Quantity of Impacted Wastewater**		**Discharger Type**	**Low - Estimated Total Annual Quantity of Nonwastewater (using median TSS concentration)**		**High - Estimated Total Annual Quantity of Nonwastewater (using mean TSS concentration)**		**Waste Generation Assumptions**
		U.S. tons of wastewater	*Metric tons of wastewater*		*U.S. tons of nonwastewater*	*Metric tons of nonwastewater*	*U.S. tons of nonwastewater*	*Metric tons*	
Abbey Color, Inc., Philadelphia, PA	$2,440,000	8,965	8,135	Indirect	6	5	17	15	based on revenue, indirect discharger
AC&S, Incorporated, Nitro, WV	$4,880,000	33,150	30,082	Direct	28	25	57	52	PCS database, direct discharger
Apollo Colors, Rockdale, IL	$54,981,779	268,147	243,328	Indirect	165	150	510	462	based on revenue, indirect discharger
Chemical Compounds, Inc., Newark, NJ	$3,106,315	17,625	15,994	Indirect	11	10	33	30	based on revenue, indirect discharger
Dye Specialties, Jersey City, NJ (This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.)	$388,289	156	142	Indirect	0.10	0	0.30	0	based on revenue, indirect discharger
European Color, PLC., Fall River, MA	$59,948,868	381,289	345,997	Indirect	235	214	725	658	based on revenue, indirect discharger
Galaxie Chemical, Paterson, NJ (1)	$3,727,578	136,985	124,305	Indirect	85	77	260	236	based on comment to proposed listing DPLP-00012
Industrial Color Company, Inc., Joliet, IL	$4,659,473	28,431	25,799	Indirect	18	16	54	49	based on revenue, indirect discharge

Table 4-6. Estimated Wastewater and Sludge Quantities									
Company and Facility Location	**Estimated Total Annual Revenues from Impacted Dye, Pigment, and FD&C Production**	**Estimated Total Annual Quantity of Impacted Wastewater**		**Discharger Type**	**Low - Estimated Total Annual Quantity of Nonwastewater (using median TSS concentration)**		**High - Estimated Total Annual Quantity of Nonwastewater (using mean TSS concentration)**		**Waste Generation Assumptions**
		U.S. tons of wastewater	*Metric tons of wastewater*		*U.S. tons of nonwastewater*	*Metric tons of nonwastewater*	*U.S. tons of nonwastewater*	*Metric tons*	
Magruder Color Company, Cartaret, NJ	$52,419,069	191,716	173,971	Indirect	118	107	364	331	based on revenue, indirect discharger
Magruder Color Company, Elizabeth, NJ	$52,419,069	191,716	173,971	Indirect	118	107	364	331	based on revenue, indirect discharger
TOTAL - Magruder Color Company	$104,838,138	383,432	347,942		237	215	729	661	
Max Marx Color, Irvington, NJ	$5,591,367	35,747	32,438	Indirect	22	20	68	62	based on revenue, indirect discharger
Nation Ford Chemical Co., SC (2)	7,500,000	1,642,277	1,490,270	Direct	1,367	1,240	2,846	2,582	PCS database, direct discharger
Passaic Color and Chemical, Paterson, NJ	$10,354,384	51,535	46,765	Indirect	32	29	98	89	based on revenue, indirect discharger
Rose Color, Newark, NJ	$2,684,000	13,738	12,466	Indirect	8	8	26	24	based on revenue, indirect discharger
Synalloy Corporation, Spartanburg, SC	$64,109,520	125,700	114,065	Indirect	78	70	239	217	wastewater generation based on surface impoundment study, indirect discharger

Table 4-6. Estimated Wastewater and Sludge Quantities									
Company and Facility Location	**Estimated Total Annual Revenues from Impacted Dye, Pigment, and FD&C Production**	**Estimated Total Annual Quantity of Impacted Wastewater**		**Discharger Type**	**Low - Estimated Total Annual Quantity of Nonwastewater (using median TSS concentration)**		**High - Estimated Total Annual Quantity of Nonwastewater (using mean TSS concentration)**		**Waste Generation Assumptions**
		U.S. tons of wastewater	***Metric tons of wastewater***		***U.S. tons of nonwastewater***	***Metric tons of nonwastewater***	***U.S. tons of nonwastewater***	***Metric tons***	
United Color Manufacturing, Inc., Newton, PA	$1,035,438	5,348	4,853	Indirect	3	3	10	9	based on revenue, indirect discharger
TOTAL	**$2,497,711,634**	**24,375,203**	**22,119,059**		**48,727**	**44,215**	**75,339**	**68,368**	

(1) Galaxie Chemical Corporation. -- Wastewater generation based on comment #DPLP-00012. Stated that they currently discharge 90,000 gallons per day to a POTW.

(2) Wastewater generation quantities were obtained from the PCS database. A note indicated that this facility discharges the majority of its wastewater to a POTW by permit. It is assumed that this permitted discharge would have the stricter effluent guidelines than normal indirect discharge, therefore, the sludge production calculations for direct dischargers was applied.

We believe that very few facilities generate still bottoms or heavy ends from the production of triarylmethane dyes or pigments. BASF Corporation, in making a public comment regarding the original listing proposal, stated that they are the only facility remaining that produce triarylmethane dyes using aniline as a reactant.[59] Information obtained from the U.S. International Trade Commission in 1994 appears to confirm BASF's assertion. No literature was identified to estimate the waste generation to product production ratio for still bottoms. However Radian (1977) describes the manufacture of TAM dyes using aniline as a reactant.[60] The limited information obtained from this report indicates that in excess of five parts of aniline are used in conversion of one part of TAM dye; it is assumed that still bottoms will be equivalent to approximately five percent of the aniline used. This results in a still bottom generation ratio of 0.00013 tons of waste per pound of product.

The quantity of solids generated by the following remaining waste streams are assumed to be very minor. Some of these waste types may be included in the estimated wastewater treatment sludge estimates. No information regarding the actual generation rates of these waste streams within the dye and pigment industry was found.

- Spent Catalysts
- Spent Adsorbent
- Equipment Cleaning Sludge
- Product Standardization Filter Cake, and
- Dust Collector Filter Fines

Several limitations were encountered during the waste quantity determinations. Limited data regarding the facilities actual waste volumes were available. The specialty chemical industry consists of a wide range of manufacturing processes and plant sizes. Data available regarding the waste generation rates at specialty chemical facilities had very high standard deviations as noted above with the TSS values reported in the OCPSF Effluent Guidelines document. These high standard deviations and the high coefficients of variability indicate that the majority of the specialty chemical manufacturers are small plants and that a few plants are extremely large in comparison. This skewed data for wastewater generation and TSS influent values creates a potential to over estimate the wastewater and sludge generation rates at smaller producing facilities and a potential to under estimate the wastewater and sludge generation rates at large producing facilities.

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59 Buller, Manfred, BASF Corporation, letter to RCRA Docket Information Center, U.S. Environmental Protection Agency regarding "RCRA Docket Number F-94-DPLP-FFFFF EPA Proposed Rule on Identification and Listing of Hazardous Waste for the Dye and Pigment Industries, January 20, 1997. DPLP-L0004.

60 Radian Corp. 1977. Industrial Process Profiles for Environmental Use: Chapter 7 Organic Dyes and Pigments Industry. NTIS PB-281 479.

4.4 Current (Baseline) Management Practices

This section presents the baseline management methods for the list of 16 dye and/or pigment facilities operated by 15 small companies and the one expanded scope small facility.

4.4.1 Dye, Pigment and FD&C Facility Baseline Management Practices

For the dye, pigment, and FD&C facilities, the baseline management methods were determined through review of industry and trade group comments regarding the previous proposed regulations, publicly available data, the 2000 Toxic Release Inventory (TRI) Report, and internet sources.

PCS data were used to identify facilities that have NPDES discharge permits. All other facilities are assumed to discharge to a POTW given they are not listed in the PCS database.

All management systems, except for no treatment, are assumed to generate sludge (i.e., nonwastewaters). Sludge generated by chemical or biological treatment is collected in a clarifier. Collected sludge will require dewatering for handling and disposal purposes. Baseline management practices for sludges may consist of off site disposal in an unregulated clay lined or unlined landfill, synthetic lined Subtitle D landfill, or a Subtitle C landfill (bulk or super sack).

According to the 1987 Development Document for Effluent Limitations Guidelines, New Source Performance Standards, and Pretreatment Standards for the Organic Chemicals and the Plastics and Synthetic Fibers Point Source Category Report (OCPSF Effluent Guidelines), the most common wastewater treatment method is an activated sludge system (biological treatment). For all facilities without site-specific information, biological treatment of wastewater with off-site unregulated unlined/clay lined disposal of sludge is assumed.[61] Table 4-7 lists the baseline management methods for the 16 small facilities.

One small facility reports surface impoundment polishing prior to discharge. Two facilities report direct discharge by a NPDES permit in the PCS database and one reports discharge to the local POTW. The remaining facilities were assumed to discharge to the local POTW.

Few facilities with available site-specific information pertaining to sludge management methods have been identified. Two facilities report off-site disposal in a synthetic lined Subtitle D landfill. The remaining facilities are assumed to manage sludge off-site in unregulated clay-lined landfills as a conservative lowest cost option.[62]

4.4.2 Expanded Scope Facilities Baseline Management Practices

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61 Assumption results in a conservative incremental compliance cost impact estimate.

62 Actual disposal may be in a synthetic lined municipal landfill.

Baseline management practices for the small business (by SBA definitions) expanded scope facility is presented in Table 4-8. We searched the Envirofacts database for the EPA Identification Number for this expanded scope facility. No EPA ID number was found for this facility. If an EPA Identification Number had been found, the facility would be researched, by number, in the EPA Hazardous Waste Report (Biennial Report) database. This would help determine if hazardous wastes currently generated may contain o-anisidine, p-cresidine, and/or 2,4-dimethylaniline. The management practices reported for the wastes identified in the Biennial Report database would then be used as the baseline management practice in the cost impact analysis. Because no EPA ID number was identified for this facility, we assumed baseline management practice for the affected nonwastewater organic wastes would be incineration. This, plus fuel blending and energy recovery is the most common management practice reported by other expanded scope facilities that completed a Biennial Report.

Table 4-7. Baseline Wastewater and Nonwastewater Management Methods for Selected Organic Dye, Pigment, and FD&C Facilities				
Facility	Wastewater Disposal Method	References	Solids Disposal Method	References
Abbey Color, Inc., Philadelphia, PA	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
AC&S, Incorporated, Nitro, WV	Holding Tank, Biological Treatment (No Cover), NPDES Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines and PCS data	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Apollo Colors, Rockdale, IL	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Chemical Compounds, Inc., Newark, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Dye Specialties, Jersey City, NJ (This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.)	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
European Color, PLC., Fall River, MA	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Galaxie Chemical, Paterson, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.

Table 4-7. Baseline Wastewater and Nonwastewater Management Methods for Selected Organic Dye, Pigment, and FD&C Facilities				
Facility	Wastewater Disposal Method	References	Solids Disposal Method	References
Industrial Color Company, Inc., Joliet, IL	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Magruder Color Company, Cartaret, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Magruder Color Company, Elizabeth, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Subtitle D Landfill	Joel Weissglass, Esq., Secretary and General Counsel, Magruder Color Company, Comments of Magruder Color Company, Inc. on the Notice of Proposed Rulemaking, Identification and Listing of Hazardous Wastes; Dye and Pigment Industries, 64 Fed. Reg. 40192, July 23, 1999, Docket Number P-99-DPIP-FFFFF., dated October 20, 1999.
Max Marx Color, Irvington, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Subtitle D Landfill	Walter Sichel, President Max Marx Color, Comments of Max Marx Color Corporation on the Notice of Proposed Rulemaking, Identification and Listing of Hazardous Wastes; Dye and Pigment Industries, 64 Fed. Reg. 40192, July 23, 1999, Docket Number F-99-DPIP-FFFFF., dated October 20, 1999.
Nation Ford Chemical Company, Fort Mill, SC	Holding Tank, Biological Treatment (No Cover), NPDES Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines and PCS Data	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.

Table 4-7. Baseline Wastewater and Nonwastewater Management Methods for Selected Organic Dye, Pigment, and FD&C Facilities				
Facility	Wastewater Disposal Method	References	Solids Disposal Method	References
Passaic Color and Chemical (Royce Associates, LP), Paterson, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Rose Color, Newark, NJ	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
Synalloy Corporation, Spartanburg, SC	Holding Tank, Biological Treatment (No Cover), Surface Impoundment with Aeration (including annual dredging), POTW Discharge, Clarifier,	Summary of Information on Onsite Management Units for Facilities Manufacturing Dyes and/or Pigments, table dated March 20, 2003.	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.
United Color Manufacturing, Inc., Newton, PA	Holding Tank, Biological Treatment (No Cover), POTW Discharge, Clarifier	Generic assumption based on 1987 OCPSF Effluent Guidelines	Unregulated Landfill (clay-lined)	Generic assumption applied for consistency with the risk assessment and for conservative low-cost baseline.

Table 4-8. Baseline and Compliance Management Practices for Small Expanded Scope Facilities						
Facility[1]	EPA ID [2]	Constituents of Concern	Hazardous Waste Description [3]	Waste Quantity (tons/year)	Baseline Management	Compliance Management
CHEM SERVICE INC, West Chester, PA	None	2,4-dimethylaniline	No EPA ID number must be a CESQG or non-generator because they are not required to have an EPA ID; assume organic waste form	Maximum CESQG categorization amount is 1.3 tons of waste per year – assume half this amount (0.7 tons) as a proxy for waste containing 2,4-dimethylaniline	Assume managed by either energy recovery or incineration	Same as Baseline

[1] Facilities reported constituents on an MSDS or chemical manufacturer lists.
[2] EPA identification number looked up in Envirofacts Database.
[3] Looked for management data in the 1999 Biennial Report database. If no wastes reported, then used 2001 Biennial Report database which is currently going through QA/QC. Selected waste stream that is most likely to contain constituent of concern, Otherwise searched 1997, 1995, 1993, 1991, and 1989 Biennial Report databases in that order.

4.5 Post-Rule (Compliance) Management Practices

Compliance waste management practices are developed to address the Subtitle C or contingent management requirements that the wastes may be subject to after listing, as proposed. Where appropriate, our analysis assumes that existing wastewater treatment impoundments would be replaced by wastewater treatment tank systems (see: Surface Impoundment Cost Estimates). Compliance costs are estimated for management of wastewater treatment sludges and solids (all nonwastewaters) assuming disposal at an off-site Subtitle C incinerator to account for future costs under Land Disposal Restrictions (LDR) program, or contingent management in a Subtitle D municipal waste type landfill that has a composite liner (e.g., clay liner and synthetic liner). Table 4-9 summarizes baseline and compliance management practices.

For the expanded scope facilities the analysis assumes that the compliance management practices will be the same as baseline. The baseline management practices of energy recovery/fuel blending and incineration will meet universal treatment standards set for the list of constituents of concern.

Table 4-9. Summary of Compliance Waste Management Practices
For Affected Organic Dye, Pigment and FD&C Facilities

Waste	Baseline	Standard Listing Approach**	Agency Preferred Approach**
K181 Waste Solids	Unregulated (Clay-Lined) Landfill*	On- or Off-site Sub C incineration and Subtitle C landfill of ash (nonstabilized), all waste.	Off-Site Municipal Waste Type Landfill (Composite Lined) for all nonwastewaters containing CoCs at or above conditional (Table 2-1) loading limits but below the nonconditional (Table 2-2) loading limit for toluene-2,4-diamine. OR On- or Off-site Sub C incineration and Subtitle C landfill of ash for facilities with wastes at or above the nonconditional (Table 2-2) mass-loading limit for toluene-2,4-diamine.

Table 4-9. Summary of Compliance Waste Management Practices For Affected Organic Dye, Pigment and FD&C Facilities			
Waste	Baseline	Standard Listing Approach**	Agency Preferred Approach**

* Used to derive high-end incremental compliance cost estimate.

** Sampling and analytical costs only included for facilities generating greater than 1,000 metric tons of nonwastewaters (K181) per year. Sampling and analysis conducted to determine if facility wastes are below the constituent-specific load-based risk standards. Facilities generating less than 1,000 metric tons per year are assumed to use operator knowledge of their processes to make this determination.

4.6 Baseline and Compliance Waste Management, Administrative, and Sampling and Analytical Costs

Landfill Costs

Costs for landfill disposal were developed from the Remedial Action Cost Engineering and Requirements (RACER)[63] cost estimating software, and the March 2000 Remediation Market Report Published by Chartwell (Chartwell). Costs in RACER are based on 2002 Environmental Cost Handling Options and Solutions (ECHOS) cost database. The RACER disposal cost for hazardous and nonhazardous wastes is presented as a 30 city average of major cities across the United States. Chartwell reports the average costs of Subtitle D commercial landfill by state. For the purposes of this analysis, the state averages were averaged for a national average cost of disposal. All costs were inflated to 2003 dollars for this estimate using the Consumer Price Index. Landfill costs for small quantity shipments (set at less than 10 tons) were estimated using jumbo sack disposal costs for dry sludges/solids (non pumpable) to account for higher costs associated with smaller shipments (i.e., less than full loads). No minimum charge is assumed for the disposal of waste in Subtitle D landfills as there is no regulation of non-hazardous waste storage times; therefore, each non-hazardous waste load will be a full 18-ton load.

Disposal of solid waste in unregulated unlined landfills was estimated using the Subtitle D landfill disposal unit cost. Fifty percent of the Subtitle D landfill cost ($21.30) was used as a proxy for unregulated clay-lined landfill disposal costs based on best engineering judgment assuming the composite liner and other Subtitle D requirements account for half the cost.

Table 4-10. Landfill Unit Costs
(dollars/ton)

Cost Element	Baseline (2003 dollars)	Source
Unregulated Clay-lined Landfill	$21.30	Best Engineering Judgement
Subtitle D Landfill	$42.60	Chartwell
Small Quantity Jumbo Sack Sludge Subtitle C Landfill (non-pumpable)	$363.1	RACER
Bulk Sludge Subtitle C Landfill (non-pumpable)	$227.9	RACER

63 Costs were developed from the Remedial Action Cost Engineering and Requirements (RACER) cost estimating software, published by Earth Tech, Inc., 2003. Costs in this software are based on 2003 Environmental Cost Handling Options and Solutions (ECHOS) cost database. The database is copyrighted by Talisman Partners, LTD, and ECHOS, LLC. The database incorporates cost data from the Environmental Remediation Cost Data - Assemblies, 9th Annual Edition, 2003, which is published by R.S. Means Company and Talisman Partners, LTD.

Incineration Costs

Costs for commercial incineration were developed from RACER and the Hazardous Waste Resource Center's January 2002 Incinerator and Landfill Cost Data survey[64] (HWRC). The HWRC data present the results of a survey of the Environmental Technology Council (ETC). All costs were inflated to 2003 dollars for this estimate using the Consumer Price Index. Incineration costs for shipment quantities less than ten tons were estimated using jumbo sack disposal costs and 55-gallon drum disposal costs for dry sludges/solids and pumpable sludges, respectively. Costs for small quantities of non-pumpable sludge was estimated using a 30 percent markup over the bulk incineration unit cost to account for additional handling costs. The markup for small quantities was approximated using the unit cost increase between jumbo sack and bulk Subtitle C landfill (approximately 37 percent).

On-site incineration (rotary kiln) costs were estimated using the workbook methodologies developed by industry experts.[65] On-site incineration costs were originally developed using these workbook methodologies utilizing 1994 input values (fuel, electricity, etc.). The costs were inflated from 1994 dollars to 2003 dollars using the Chemical Engineering Plant Cost Index for capital costs and the Consumer Price Index for O&M costs.

On-site incineration costs do not include the cost of ash disposal. Ash generation is estimated to be 20 percent of the total mass incinerated and is disposed in a Subtitle C landfill.

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64 Hazardous Waste Resource Center Http://www.etc.org/costsurvey6.cfm

65 Vogel, Gregory A., MITRE Corporation, *The Estimation of Hazardous Waste Incineration Costs*, sponsored by U.S. EPA, January, 1983, and K. Lim, R. DeRosier, R. Larkin, and R. McCormick, Acurex Corporation, Energy & Environmental Division, *Retrofit Cost Relationships for Hazardous Waste Incineration*, prepared for the U.S. EPA, Office of Research and Development, Industrial Environmental Research Laboratory, Incineration Research Branch, January, 1984.

Table 4-11. Incineration Unit Costs (dollars/ton)		
Cost Element	Baseline (2003 dollars)	Source
On-site Rotary Kiln Incineration of Non-pumpable Sludge	147.2 * (tons) + $927,503 = total dollars	Cost and Economic Impact Analysis of Listing Hazardous Wastes from the Organic Dye and Pigment Industries, prepared for the Office of Solid Waste Regulatory Analysis Branch USEPA by DPRA Incorporated, November 28, 1994
Off-site Bulk Incineration of Non-pumpable Sludge	$560.14	HWRC
Off-site Bulk Incineration of Pumpable Sludge	$1,033.2	HWRC
Off-site Small Quantity Incineration of Non-pumpable Sludge	$728.2	Assumed a 30 percent markup of off-site bulk incineration of non-pumpable sludge to reflect higher costs for smaller quantities
Off-site Bulk Incineration of Pumpable Sludge (drummed)	$1,947.5	HWRC

Dewatering

Costs for dewatering of pumpable sludges for disposal were developed using RACER and Documentation for Phase IV LDR Cost Equations Memo dated July 1997 (Phase IV LDR Memo). RACER unit costs were used for facilities generating less than 2,000 gallons per day (gpd) of wastewater. The technology assumed using RACER unit costs is a belt filter press with polymer addition. The Phase IV LDR Memo present curve fit costs for two system sizes range from 2,000 to 250,000 gpd and 250,000 to 5,200,000 gpd. The Phase IV LDR Memo dewatering technology is a centrifuge with a polymer feed system. The Phase IV LDR Memo cost curves were inflated from 1997 dollars to 2003 dollars using the Chemical Engineering Plant Cost Index for capital costs and the Consumer Price Index for O&M costs. All capital costs for both technologies were annualized over 15 years at a 7 percent CRF (0.1098).

Table 4-12. Dewatering Cost Curves (dollars/gallon wastewater)		
Cost Element	Baseline (2003 dollars)	Source
Belt Filter Press (systems sized less than 2,000 gpd)	0.0633 * (GPD) + 17,935 = total dollars	RACER
Centrifuge (systems sized 2,000 gpd to 250,000 gpd)	467.8 * (gpd)^0.5 + 38,560 = total dollars	Phase IV LDR Memo
Centrifuge (systems sized 250,000 gpd to 5,200,000 gpd)	0.62 * (gpd) +124,370 = total dollars	Phase IV LDR Memo

Transportation Costs

Hazardous waste transportation costs (excluding manifesting costs which are estimated separately) were estimated based on van trailer and roll-off bin trucking unit costs reported in RACER (Table 4-13). Costs are based on distance and maximum truck load size of 18 tons. An 18-ton limit is assumed as the maximum truck load size assumed in the RACER cost estimating software. Highways have a 40-ton gross weight limit for trucks, this includes the cab, trailer, and load. A minimum of four loads per year is assumed based on the maximum accumulation period of 90 days for hazardous waste disposal based on accumulation time regulations. Otherwise, the number of loads per year is calculated by dividing the total annual generation quantity by the assumed maximum truck load size of 18 tons. For smaller quantity generators (i.e., annual waste disposal below 40 tons per year), a truck load size of 5 tons was assumed (half our 10-ton small quantity designation discussed previously). The ECHOS minimum shipment fee of $730 is used to determine transportation unit costs below 200 miles for hazardous waste. For example, the transportation cost for shipping waste 100 miles is calculated by dividing the minimum shipment fee by 100 miles ($730/100 miles = $7.30/mile). Transportation costs are presented below. Table 4-14 presents how shipping distances vary when shipping to Subtitle C landfills (338 mile weighted average). The distances presented in the EPA, Evaluation of Cost and Economic Impacts of F006 Recycling Rulemaking Options from December 2001 for landfill disposal of electroplating wastes (based on a sample of 75 facilities) were utilized as a proxy for the transportation distances for sludge disposal.

Non-hazardous waste transportation costs (excluding manifesting costs) also were estimated based on bulk hazardous waste transportation costs reported in RACER. Costs are based on distance and a maximum load size of 18 tons. Due to the relatively close transportation distances estimated for Subtitle D landfills, a unit cost of $2.21 per mile ($0.12 per ton-mile) was used. The transportation cost is estimated to be less than the hazardous transportation unit cost due to the regularly scheduled, full 18-ton, bulk non-hazardous waste shipments. For non-hazardous waste and post rule product recycling, no minimum number of loads is assumed. The number of shipments per year is calculated by dividing the total annual generation quantity by the assumed maximum truck load size of 18 tons.

Table 4-13. Transportation Unit Costs [1]	
Cost Element	Baseline
Roll Off Bin (Bulk)	
Loading/Unloading	$2.60/ton
Hazardous Waste Minimum Charge	$730/shipment
Hazardous Waste Shipping:	
200-299 miles	$2.66/mile
300-399 miles	$2.41/mile
400-499 miles	$2.20/mile
500-599 miles	$2.10/mile
600-699 miles	$2.06/mile
700-799 miles	$1.98/mile
800-899 miles	$1.98/mile
900-999 miles	$1.98/mile
1,000+ miles	$1.94/mile
Non-Hazardous Waste	$2.21/mile
Van Trailer (Super Sack or Drums)	
Loading/Unloading	$2.60/ton
Hazardous Waste Minimum Charge	$760/shipment
Hazardous Waste Shipping:	
200-299 miles	$3.63/mile
300-399 miles	$3.35/mile
400-499 miles	$3.03/mile
500-599 miles	$2.88/mile
600-699 miles	$2.82/mile
700-799 miles	$2.71/mile
800-899 miles	$2.71/mile
900-999 miles	$2.71/mile
1,000+ miles	$2.63/mile

[1] Costs inflated from 2000 dollars to 2003 dollars for van-trailer costs and from 2002 to 2003 dollars for roll-off bin costs.

Weighted transportation costs are presented in Table 4-14 for transport to Subtitle C landfill. The weighted average transportation unit cost to Subtitle C landfill is $3.81/mile and the weighted average distance is 338 miles. The assumed average transportation unit cost to an incineration facility is $3.26/mile at an average distance of 577 miles. The assumed average transportation unit cost to a Subtitle D landfill is $2.21/mile and an average distance of 50 miles. The estimates for Subtitle C landfill transportation distances were taken from the December 2001 F006 Recycling Rulemaking Options report, as indicated above. Table 4-14 reflects the distribution of distances that the top 75 electroplaters (in terms of generation quantity) are shipping their waste for disposal in Subtitle C landfills. These transportation distances for electroplaters are assumed to be similar to those that dye, pigment, and FD&C facilities are shipping their wastes.

Table 4-14. Weighted Average Transportation Unit Costs to Subtitle C Landfills [1]					
Distribution Percentile (%)	Distance to Landfill (miles, n = 75)	Average Distance per 10th Percentile (miles)[2]	Weighted Distance to Subtitle C Landfill (miles)	Unit Price (dollars/mile)[3]	Weighted Unit Price (dollars/mile)
0	38	---	---	---	---
10	129	83.5	8.35	$8.75	$0.87
20	147	138	13.8	$5.29	$0.53
30	166	156.5	15.65	$4.67	$0.47
40	175	170.5	17.05	$4.28	$0.43
50	234	204.5	20.45	$2.66	$0.27
60	283	258.5	25.85	$2.66	$0.27
70	348	315.5	31.55	$2.41	$0.24
80	434	391	39.1	$2.41	$0.24
90	636	535	53.5	$2.10	$0.21
100	1627	1,131.5	113.15	$1.94	$0.19
Total			338.45		$3.81

[1] U.S. EPA, Evaluation of Cost and Economic Impacts of F006 Recycling Rulemaking Options, December 2001.
[2] Calculated by averaging distance to landfill for each 10th percentile. For example, the average distance for the 20th percentile (138 miles) is calculated by averaging 129 miles (distance at 10th percentile) and 147 miles (distance at 20th percentile).
[3] Costs inflated from 2000 dollars to 2003 dollars using the Consumer Price Index.

Manifesting Costs

In general, under the current hazardous waste regulations, wastes are tracked through the use of a hazardous waste manifest which accompanies each waste shipment. Manifesting costs were obtained from the Hazardous Waste Manifest Cost Benefit Analysis, prepared by Logistics Management Institute in October 2000. Costs were inflated to 2003 dollars using the Consumer Price Index. The manifesting cost incurred by the generator per manifest was determined to be $89.31 for small quantity generators and $136.91 for large quantity generators. An average cost of $113.11 ($117.50 inflated to 2003 dollars) per manifest was assumed to be incurred by the generator. The transporter is assumed to incur $117.35 ($121.92 inflated to 2003 dollars) in manifesting costs per shipment. The transporter and generator costs were combined to estimate a total manifesting cost per shipment of $230.46 ($239 inflated to 2003 dollars).

Costs also have been estimated for shipping papers for non-hazardous wastes. Costs to prepare, carry, and retain shipping papers were obtained from the Hazardous Waste Manifest Cost Benefit Analysis. The cost for the generator to complete the shipping papers for each load is estimated to be $26.50, based on assumed effort of 0.5 hours by a technical staff member at $53 per hour.[66] The cost for the generator to maintain a copy of the disposal agreement is $2.70 per year. Assuming an average of four shipments per transporter per year, the cost per shipment for the generator to retain the reclamation agreement is approximately $0.68 per shipment. The cost for the transporter to record and carry the shipping papers and reclamation agreement is estimated at $58.53 per shipment. An additional $4.59 was assumed to be incurred by the transporter to retain the records for each generator. Assuming an average of four shipments per generator for each transporter a year, the cost per shipment for the transporter to retain the records for each generator is approximately $1.15. The transporter and generator costs were combined to estimate a total cost to prepare, carry and retain shipping papers of $86.86 ($90.40 inflated to 2003 dollars) per shipment.

Cost for disposal of wastes in unregulated or Subtitle D landfills include costs for shipping papers. All other methods of off-site disposal include costs for hazardous waste manifest.

RCRA Part B Permit

Costs for the RCRA Part B Permit were estimated using Estimated Costs for the Economic Benefits of RCRA Noncompliance dated September 1997. A Part B permit for general facility requirements and incinerator requirements were included for construction and operation of an on-site sludge rotary kiln. A cost of $43,693 ($51,924 inflated from 1997 to 2003 dollars using the Consumer Price Index) for the general facility requirements and $22,296 ($26,495 inflated from 1997 to 2003 dollars) for the incinerator requirements. Permit costs were annualized over 10 years at a 7 percent rate for borrowing capital (0.14238).

Sampling and Analytical

The individual constituents of concern (CoCs) were compared to the EPA Publication SW-846 to determine standard analytical methods available at commercial laboratories. Of the eight CoCs, four did not have standard methods listed in SW-846.

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66 Hourly rate from *Supporting Statement for Information Collection Request Number 801 "Modifications of the Hazardous Waste Manifest System – Proposed Rule"* July 19, 2000. [Note: Hourly rates for technical labor fall within a range depending upon geographic location, and source. The ICR uses a rate of $58.82, which is considered to be within the acceptable range.]

Table 4-15. Test Method List for Proposed Dye and Pigments CoCs Mass Loadings			
Test Method	Description	Number of CoCs	CoCs[1]
8270	SVOCs	4	Aniline (8131) o-Anisidine 4-Chloroaniline (8131, 8410) p-Cresidine
–	No Method Identified	4	2,4-Dimethylaniline (2,4-xylidine) 1,2-Phenylenediamine 1,3-Phenylenediamine Toluene-2,4-diamine
[1] Additional analytical methods from SW-846 for the CoCs are listed next to the CoC in parentheses. Two CoCs are listed with multiple methods in the SW-846 document.			

Pace Analytical Labs (Pace) was contacted to obtain vendor quotes for analytical testing of the CoC list. Pace did not identify any detection protocols in-place for the four CoCs without standard test methods. Pace contacted Labseek, an internet-based membership organization, to out source analytical testing and determine if other laboratories have protocols in-place for the detection of the four CoCs. An additional five laboratories were contacted by Labseek; none of which indicated they were capable of conducting analytical tests to detect the four CoCs.

For a lab to develop a protocol for an analytical process to detect the CoCs, an appropriate method must be identified.[67] The method is usually chosen by a regulatory body (e.g., state health department). A standard of a known concentration of the chemical is then purchased to use to calibrate and develop the identification protocol for a particular piece of equipment and consists of several runs of the analytic process. The laboratory is then certified by a regulatory agency for the particular chemical and method. The establishment of the analytical process is also dependant on the media; that is, a process must be developed for liquids and solids.

Each analytical test usually includes a list of chemicals identified in the process under a single method. A request for a single chemical on the test list generally will cost the same as running the entire list of chemicals. Therefore, to identify the entire list of CoCs, a minimum of three analytical tests (one known method and two new methods) will be required.

[67] Communication with Kari Hermansen, Pace Analytical, May 15, 2003.
Identified as “New Method” A and B in this report.

Table 4-16. Test Method List for Proposed Dye and Pigments CoCs Mass Loadings			
Test Method	Description	Number of CoCs	CoCs[1]
8270	SVOCs	4	Aniline (8131) o-Anisidine 4-Chloroaniline (8131, 8410) p-Cresidine
New Method A	No Method Identified	3	1,2-Phenylenediamine 1,3-Phenylenediamine Toluene-2,4-diamine
New Method B	No Method Identified	1	2,4-Dimethylaniline (2,4-xylidine)

Cost for sampling and analytical needs were estimated using Proposed Listing for Paint Manufacturing Wastes Public Comments Summary and Response Document, prepared by DPRA, October 30, 2001, and RACER. The annual cost for sampling and analysis of a non-aqueous waste streams (i.e., nonwastewaters) for the various scenarios are shown in Table 4-17.

Table 4-17. Analytical Unit Cost (dollars/sample)		
Method	Unit Cost Per Sample	Cost Source
Aqueous SVOC (EPA 625)	$533.46	2003 Racer
Non Aqueous SVOCs Method 8270	$413	2003 Racer
New Methods (Constituents groups not listed in EPA Document SW-846)	$337.85	Proposed Listing for Paint Manufacturing Wastes Public Comments Summary and Response Document, prepared by DPRA, October 30, 2001. Acrylamide was used as a proxy for a new constituent group Inflated from 2001$ to 2003$ using CPI.
Feasibility Study (per each media and analytical method)	$1,559	Proposed Listing for Paint Manufacturing Wastes Public Comments Summary and Response Document, prepared by DPRA, October 30, 2001. Acrylamide was used as a proxy for a new constituent group Inflated from 2001$ to 2003$ using CPI.

The cost estimate for dye, pigment and FD&C facilities includes costs for sample collection, development of procedure, feasibility studies, five annual samples of each analysis for mass loading determination, and 15 samples for initial characterization of newly listed wastes. The cost estimate for the expanded scope facilities does not include the 15 samples for initial characterization of newly listed wastes given their wastes containing CoCs already have been identified as either a characteristic or listed waste. Feasibility studies, procedure development, and characterization are annualized over five years at a seven (7) percent rate for borrowing capital (0.24389). A feasibility study is required for all CoCs without a prescribed method in the EPA document SW-846 at a estimated cost of $1,559. Four of eight CoCs do not have a EPA method. As laboratories do not perform analytical testing for the proposed CoCs, all methods will require procedure development (identified as New Method A and B in this report). Procedure development consists of performing the analysis 13 times (to develop calibration curves, identify spike and dilution rates, etc.). Three laboratories are assumed to develop methods and procedures for analysis of constituents without methods and procedures already established.

Table 4-18. Average Annualized Sampling and Analysis Costs Per Facility (dollars/year)[1]

Facilities	Dye and Pigment Industry Facilities Generating >1,000 Metric Tons and (CoC Containing Wastes for all 37 D&P Facilities)		Dye and Pigment Industry Facilities Generating >1,000 Metric Tons and (CoC Containing Wastes for 16 Identified Large and Small D&P Facilities)	
	High Sludge Volume Estimate	Low Sludge Volume Estimate	High Sludge Volume Estimate	Low Sludge Volume Estimate
Dyes and Pigment Industries	$10,509	$10,688	$10,707	$10,858
Expanded Scope Facilities[2]	$2,117	$2,218	$2,149	$2,250

[1] Laboratory methodology development costs are spread across dye and pigment industry facilities generating more than 1,000 metric tons per year (11 facilities using high sludge volume estimates and 6 facilities using low sludge volume estimates) and 13 expanded scope facilities assuming that laboratories pass costs to generators. Analytical costs for dye and pigment industry facilities that were identified as generating waste containing a CoC and more that 1,000 metric tons per year (9 facilities using high sludge volume estimates and 5 facilities using low sludge volume estimates) were also determined. The 513 expanded scope facilities are further divided by the constituents of concern present in waste generated. Nine facilities generate waste containing 2,4-dimethylaniline, one facility generates waste containing o-anisidine and three facilities generate waste containing p-cresidine.
[2] Expanded scope facility annual cost is an average of the two methods development and sampling costs used to sample the three constituents.

For example, the annualized initial characterization cost is calculated as follows:

15 samples * ($413 + $338 + $338) * 0.24389 CRF = $3,984/year

An example annualized feasibility study and development cost for the analytical development costs (for all facilities generating more than 1,000 metric tons) is calculated as follows:

Method 8270: ((($0 Feasibility Study * 4 CoCs) + 13 runs * ($413)) * 0.24389 CRF)/(11 facilities generating more than 1,000 metric tons + 4 expanded scope facilities) * 3 laboratories developing analytical methods = $262/year.

New Method A: ((($1,559 Feasibility Study * 3 CoCs) + 13 runs * ($338)) * 0.24389 CRF)/(11 facilities generating more than 1,000 metric tons + 0 expanded scope facilities) * 3 laboratories developing analytical methods = $603/year.

New Method B: ((($1,559 Feasibility Study * 1 CoCs) + 13 runs * ($338)) * 0.24389 CRF)/(11 facilities generating more than 1,000 metric tons + 9 expanded scope facilities) * 3 laboratories developing analytical methods = $603/year.

New Method B: ((($1,559 Feasibility Study * 1 CoCs) + 13 runs * ($338)) * 0.24389 CRF)/(11 facilities generating more than 1,000 metric tons + 10 expanded scope facilities) * 3 laboratories developing analytical methods = $218/year.

Annual analytical costs include new methods A and B and method 8270. An example calculation of the annual sampling costs are as follows:

Dye and pigment facilities: 5 samples * ($413 + $338 + $338) = $5,445/year

Thirteen expanded scope facilities, manufacture or use o-anisidine, p-cresidine, and 2,4-dimethylaniline. Each expanded scope facility generate waste with only one of the CoCs o-anisidine, p-cresidine, or 2,4-dimethylaniline. Expanded scope facilities only shared in the costs for developing methods (feasibility and calibration studies) for new method B.

Annualized sampling and analysis costs are dependant upon the number of facilities that will share the development costs. The greater the number of facilities that fall under the proposed ruling, the lower the cost for the method development. Expanded scope facilities do not include the cost for initial characterization as the wastes are already managed for other hazardous constituents and would have been characterized already.

Example calculations for the total annual sampling and analytical costs for the dye and pigment facilities and expanded scope facilities are as follows:

Dye and pigment facilities:	$3,983/year characterization + $262/year Method 8270 development + $603/year new method A development + $218/year new method B development + $5,445/year annual sampling = $10,511/year (different from result of $10,509/year in Table 4-18 due to rounding)
Expanded scope facilities:	($262 Method 8270 + $218/year new method B development + (5 samples * ($413 + $338)) / 2 methods to average annual sampling costs $2,117/year average

Administrative Costs

Cost for administrative duties were derived using hour estimates for each administrative task based on "best engineering judgement." The labor rates are from the U.S. Department of Labor Statistics, "National Compensation Survey: Occupational Wages in the United States, 1997; inflated using the Consumer Price Index to 2003 dollars. Administrative costs are estimated at $1,944. Administrative costs are assumed for all facilities managing dyes and/or pigments wastes as hazardous (traditional listing option). Facilities managing dyes and/or pigments waste as nonhazardous would incur costs for preparing an exclusion report.[68] An exclusion report consists of 6 hours of staff engineer labor ($96.43 per hour) and 2 hours of clerical labor ($47.58 per hour). An exclusion report is assumed to be required every 3 years; therefore the estimated cost of $674 was annualized 3 years at a 7 percent rate of borrowing for capital (0.38105) for an annual cost of $257.

Surface Impoundment Cost Estimates

One potentially affected small business facility (Synalloy, Spartanburg, SC) has an existing surface impoundment that does not meet the Subtitle C surface impoundment minimum technological requirements. The sludge from similar facilities is normally cleaned out on an annual basis. Under a post-listing scenario, the annual generation of sludge from this facility may exceed acceptable loading levels. We have assumed that this facility will determine that waste from this unit would become listed and therefore choose to close and replace the unit prior to the effective date of the final rule. The affected facility is assumed to replace their impoundment with a tank rather than construct a Subtitle C impoundment. Costs associated with closure of the existing impoundment include the following: discharge of the wastewater to a

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68 The "exclusion report" only applies to the agency preferred option. We have assumed that facilities who could declare their wastes to be nonhazardous because they would not meet the loading level would complete this report to acknowledge (declare) that determination. [Note: This may not be a requirement under the Agency Preferred Approach but is included in an effort to capture all potential costs.]

POTW, removal and disposal of the sludge[69] at a Subtitle D landfill, and removal and disposal of two feet of contaminated soil. Sludge and contaminated soil is assumed to be shipped off-site to the appropriate management method.

Table 4-19. Surface Impoundment Management Cost Equations	
Activity	**Unit Cost or Cost Equation** (2003 dollars)
Treatment in unlined impoundment	Unlined impoundment: [1,2,3] $Y = 0.662 * X^{0.5861}$ (construction costs) $Y = \$21.817 * Z + \$2,995.9$ (dredging/disposal costs) Y = annualized cost/year X = gallons of wastewater/yr Z = tons/yr (assumes 4.7% of total sludge generation is collected in SI)
Close unlined impoundment and replace impoundment with tank and remove sludge annually	Close unlined impoundment with sludge removal and backfill of unlined impoundment (assumes 4.7% of total sludge generation is collected in SI): [1,3,4] $Y = \$2.8803 * Z + \$259.14$ Tank system: [1] $Y = 0.1556 * X^{0.704}$ Y = annualized cost/year Z = ton/yr
[1] Capital costs annualized assuming a before-tax interest rate of seven percent over 20 years. [2] Capital costs for an unlined impoundment based on the Memorandum Re: Hazardous Waste Identification Rule for Process Wastes: Waste Management Cost Data, dated September 27, 1996. [3] Costs for tanks systems and dredging were estimated using RACER 2003 software. [4] Surface Impoundment is assumed to be closed prior to regulation and no RCRA closure activities will be required.	

4.7 Corrective Action Compliance Costs

69 Surface impoundment sludge generally cleaned out once per year. Quantity removed and disposed based on assumption of "average" annual quantity, or 50 percent of the annual sludge generation at the impoundment.

Incremental corrective action costs associated with unpermitted facilities include the cost to conduct a RCRA Facility Investigation (RFI), a Corrective Measures Study (CMS), and remediate solid waste management units (SWMUs) and areas of concern (AOCs). Under the Agency Preferred Approach, no small business will seek a RCRA permit to operate an on-site incinerator if their wastes contain CoCs at concentrations exceeding the nonconditional listing mass-loading listing levels. Therefore, no facility is expected to seek a RCRA permit that could possibly trigger corrective action. Corrective action costs are not realistically anticipated under the Agency Preferred Approach.

Under the Standard Listing Approach, some of the unpermitted facilities will be brought into the RCRA program if they seek a RCRA Part B permit for construction and operation of an on-site incinerator. RCRA corrective action is typically triggered by facilities seeking a RCRA permit. Under the Standard Listing Approach it is estimated that one small business will seek a RCRA permit to operate an on-site incinerator because it would be more economical than managing the newly listed waste in an off-site commercial incinerator. This facility may incur corrective action costs. Potential corrective action costs were not estimated and are not included in this analysis.

5.0 COST AND ECONOMIC IMPACT ANALYSIS

Aggregate annualized compliance costs and economic impacts are presented in this chapter for small businesses in the dyes and pigments industries. This chapter also examines estimated impacts to expanded scope facilities and affected landfills. The first section of the chapter addresses aggregate annualized compliance cost impacts to the affected dye and pigment companies. The second section addresses economic impacts. The third section addresses impacts to the expanded scope facilities (i.e., non-dye, pigment, and FD&C facilities). The final brief section addresses the landfill impacts.

5.1 Cost Impacts

Incremental cost estimate results are presented in Table 5-1 for the 15 small businesses. Total baseline waste management costs range from $1.0 to $3.0 million per year depending on the total suspended solids concentration in the wastewater and the number of facilities that generate wastes containing one or more of the eight constituents of concern (CoCs) listed in Table 2-1. Incremental cost impacts are presented below for various analytical scenarios under the Agency Preferred Approach and the traditional listing option. Under the Agency Preferred Approach, we assume that whenever possible, facilities will choose the least cost option of disposing of wastes in composite-lined MSW landfills. Therefore only those facilities assumed to generate nonwastewaters containing toluene-2,4-diamine at or above the mass-loading limit would be required to manage this waste as RCRA hazardous.

"Low" and "High" Most Likely Scenario cost estimates have been developed for the four small companies identified as potentially generating wastes likely to contain one or more of the eight constituents of concern. The Low Most Likely Scenario assumes all the four small facilities/companies generate wastes with CoCs at levels below the nonconditional (Table 2-2) listing mass-loading limit. IN this case, all four facilities are assumed to manage all their waste at an approved lined landfill. Incremental compliance costs for this Low Most Likely Scenario of the Agency Preferred Approach range from $0.05 to $0.08 million per year. The "High" Most Likely Scenario also covers only the four companies identified as having wastes potentially containing CoCs. However, under this scenario, we assume that only one of the two facilities reporting toluene-2,4-diamine generates waste above the nonconditional listing mass-loading limit[70]. Thus, because incremental waste quantities above the mass loading limit are not estimated, we assume that 100 percent of the nonwastewater waste at this facility is managed as hazardous. The remaining facilities are assumed to send all their waste to an approved lined landfill. Incremental compliance costs for the High Most Likely Scenario of the Agency Preferred Approach range from $0.07 to $0.1 million per year. Under the standard listing option (all nonwastewaters automatically hazardous), incremental compliance costs range from $1.4 to

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[70] Dye Specialties and Passaic Color and Chemical were the two facilities reporting toluene-2,4-diamine. Dye Specialties was found to generate negligible quantities of nonwastewaters. Thus, we only include Passaic in this analysis.

$1.5 million per year assuming only the four small companies generate waste containing CoCs.

"Low" and "High" Worse Case Scenario cost estimates also have been developed for all 15 small companies. The Low Worse Case Scenario assumes that all 15 companies generate wastes containing CoCs below the nonconditional listing mass-loading levels (Tables 2-1 and 2-2). Incremental compliance costs for the Low Worse Case Scenario of the Agency Preferred Approach range from $0.08 to $0.17 million per year. The "High" Worse Case Scenario also assumes that all 15 companies identified have wastes containing CoCs, however, only one facility is assumed to have wastes above the nonconditional listing mass-loading level (Table 2-2). Incremental compliance costs for the High Worse Case Scenario of the Agency Preferred Approach range from $0.1 to $0.2 million per year. As discussed above, due to lack of data on incremental quantities potentially above loading limits, we assume that 100 percent of all nonwastewater quantities at each facility is managed, as required. Furthermore, we assume that whenever possible, facilities will choose the least cost option of disposing of wastes in composite-lined MSW landfills. Therefore only those facilities assumed to be generating nonwastewaters containing toluene-2,4-diamine at or above the mass-loading limit would be required to manage this waste as RCRA hazardous. Incremental compliance costs for the Standard Listing Approach (all nonwastewaters hazardous) range from $1.5 to $3.3 million per year, assuming all 15 companies generate waste containing CoCs.

TABLE 5-1. SUMMARY OF SMALL BUSINESS BASELINE, COMPLIANCE, AND INCREMENTAL COSTS FOR MANAGEMENT OF K181 WASTE ($MILLION/YEAR; 2003 DOLLARS)

Parameter	Baseline	Standard Listing Approach*	Agency Preferred Approach*	
			Low (Nonconditional mass-loading listing levels not exceeded)	High (Nonconditional mass-loading listing levels exceeded for one facility)
Most Likely Scenario: Only Including 4 Small Companies Identified Generating Wastes with Constituents of Concern				
Low - High Nonwastewater (K181) Generation Estimate	$1.0 - $1.1	$2.4 - $2.6	$1.1 - $1.2	$1.1 - $1.2
Incremental Cost Above Baseline	---	**$1.4 - $1.5**	**$0.05 - $0.08**	**$0.07 - $0.1**
Worse Case Scenario: Including All 15 Small Companies				
Low - High Nonwastewater (K181) Generation Estimate	$2.9 - $3.0	$4.4 - $6.3	$3.0 - $3.2	$3.0 - $3.3

TABLE 5-1. SUMMARY OF SMALL BUSINESS BASELINE, COMPLIANCE, AND INCREMENTAL COSTS FOR MANAGEMENT OF K181 WASTE ($MILLION/YEAR; 2003 DOLLARS)				
Parameter	**Baseline**	**Standard Listing Approach***	**Agency Preferred Approach***	
			Low (Nonconditional mass-loading listing levels not exceeded)	**High (Nonconditional mass-loading listing levels exceeded for one facility)**
Incremental Cost Above Baseline	---	**$1.5 - $3.3**	**$0.08 - $0.17**	**$0.1 - $0.2**

* Sampling and analytical costs only included for facilities generating greater than 1,000 metric tons of waste solids (K181) per year. Sampling and analysis conducted to determine if facility wastes are below the constituent-specific load-based risk standards. Facilities generating less than 1,000 metric tons per year are assumed to use operator knowledge of their processes to make this determination.

Table 5-2 presents the cost impact results for the expanded scope facilities. Only one expanded scope facility generating one waste of concern was identified as small based on employment. No incremental compliance management costs are identified or assumed for this small business. Incremental sampling and analysis costs are anticipated at approximately $2,149 per constituent. Table 5-2 also presents the percent of corporate sales impacts for the one small business that manufactures or uses 2,4-dimethylaniline. Percent of corporate sales impacts are estimated to be about 0.08 percent for this facility.

Table 5-2. Summary of Small Business Impacts for the Expanded Scope Facilities									
Facility[1]	EPA ID [2]	Constituents of Concern	Hazardous Waste Description [3]	Waste Quantity (tons/year)	Baseline Mgmt.	Compliance Mgmt.	Incremental Compliance Costs ($/yr) [4]	Corporate Sales	Percent of Corporate Sales
CHEM SERVICE INC. West Chester, PA	None	2,4-dimethylaniline	No EPA ID number must be a CESQG or non-generator because they are not required to have an EPA ID; assume organic waste form	Maximum CESQG categorization amount is 1.3 tons of waste per year – assume half this amount (0.7 tons) as a proxy for waste containing 2,4-dimethylaniline	Assume managed by either energy recovery or incineration	Same as Baseline	$2,149	$2,700,000	0.07959%

[1] Facility reported constituents on an MSDS or chemical manufacturer lists.
[2] EPA identification number looked up in Envirofacts Database.
[3] Looked for management data in the 1999 Biennial Report database. If no wastes reported, then used 2001 Biennial Report database which is currently going through QA/QC. Selected waste stream that is most likely to contain constituent of concern. Otherwise searched 1997, 1995, 1993, 1991, and 1989 Biennial Report databases in that order.
[4] Sampling and analytical costs estimated to be $2,149 per facility per year.
[5] Dun & Bradstreet. 2003. Market Spectrum Database.

5.2 Economic Impacts on the Small Business Dyes, Pigments, and FD&C Industries

The organic dyes and pigments industries produce dyes and pigments for a wide variety of intermediate and end users, including food, drugs and cosmetics. A total of 16 facilities owned by 15 small companies are expected to be impacted by the proposed rulemaking. Table 5-3 presents summary information on these facilities and their corporate owners, including corporate revenues and the sources of these estimates.

5.2.1 Methodology

An economic impact analysis of the proposed rulemaking was conducting by using the incremental management costs derived in Section 5.1 of this report in conjunction with estimated waste generation and production rates. Estimates were completed on a facility specific basis. Information regarding waste generation rates were derived from various sources as noted previously in Chapter 4. Estimates of dye and pigment production rates, and product sales were derived based on information provided in corporate websites, Dun and Bradstreet and various assumptions, due to a lack of facility-specific information. Only publicly available information was used to generate these estimates.

<u>Waste Generation Rates and Waste Management Costs</u>

Waste generation rates are variable in the dyes and pigments industries, depending on the product being manufactured. Because actual wastewater sludge generation rates are not known, two assumptions were utilized to estimate waste generation, resulting in a range of estimates.

As described in Chapter 4, annual wastewater treatment sludge generation rates were estimated for the 16 facilities (15 companies) based on two sources. Wastewater treatment sludge generation rates were estimated for the facilities based on data from the 1987 OCPSF Effluent Guidelines report.[71] A low sludge generation rate was estimated using a lower TSS concentration represented by the median values from the OCPSF report and alternatively a high generation rate was estimated based on the mean TSS concentrations form the OCPSF report, as described in Chapter 4. Incremental waste management costs were then estimated for both waste generation assumptions, for each of the regulatory approaches. Estimates of cost impacts are presented based on both of these low and high sludge generation assumptions, resulting in a range of impact estimates.

[71] U.S. EPA, 1987.

Table 5-3. Estimated Corporate, and Dye and Pigment Revenues For the Small Affected Dye, Pigment and FD&C Companies		
Company and Facility Location	**Total Corporate Annual Gross Revenues 2003 U.S. dollars**	**Source of Corporate Annual Gross Revenues**
Abbey Color, Inc., Philadelphia, PA	$5,075,000	Dun & Bradstreet
AC&S, Incorporated, Nitro, WV	$10,150,000	Dun&Bradstreet
Apollo Colors, Rockdale, IL	$63,532,000	Freedonia *
Chemical Compounds, Inc., Newark, NJ	$3,230,000	Freedonia *
Dye Specialties, Jersey City, NJ (This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.)	$8,076,000	Freedonia *
European Color, PLC., Fall River, MA	$69,272,000	www.ecplc.com
Galaxie Chemical, Paterson, NJ	$4,307,000	Freedonia *
Industrial Color Company, Inc., Joliet, IL	$5,384,000	Freedonia *
TOTAL - Magruder Color Company 1.) Cartaret, NJ 2.) Elizabeth, NJ	$121,142,000	Freedonia *
Max Marx Color, Irvington, NJ	$6,461,000	Freedonia *
Nation Ford Chemical Company, Fort Mill, SC	$15,225,000	Dun & Bradstreet
Passaic Color and Chemical, Paterson, NJ	$21,536,000	Freedonia *
Rose Color, Newark, NJ	$5,583,000	Dun and Bradstreet
Synalloy Corporation, Spartanburg, SC	$95,245,000	Synalloy 200110K *
United Color Manufacturing, Inc., Newton, PA	$2,154,000	Freedonia *

* Adjusted to 2003 dollars using the GDP implicit price deflator; rounded to nearest $1,000

5.2.2 Estimated Corporate-Level Impacts

To examine the potential economic impact of the proposed rulemaking on each of the small corporate entities, the incremental regulatory costs are compared to gross annual corporate sales. As Table 5-4 shows average impacts are expected to range from 0.04 to 0.08 percent of corporate sales for all small companies under the Agency Preferred Approach under the high waste generation assumption. Average impacts of only 0.04 percent are expected if all facilities generate wastes which contain the constituents of concern and none of the facilities exceed the mass-loading listing level. Impacts are notably higher under the Standard Listing Approach, averaging 1.32 percent of corporate sales if all facilities generate nonwastewaters containing the constituents of concern. This average impact percentage drops to only 0.69 percent if only the facilities reporting constituents of concern are ultimately affected.

Table 5-5 presents impacts under the low waste generation assumption. Impacts are less under this assumption, with average impacts for the Agency Preferred Approach ranging from 0.02 percent to a high of 0.04 percent if all facilities generate wastes containing constituents of concern and one facility exceeds the mass-loading listing level. Under the Standard Listing Approach, impacts are estimated to be 0.62 percent if all facilities generate wastes containing constituents of concern. The average impact percentage drops to only 0.39 percent if only the facilities reporting constituents of concern are ultimately affected.

Table 5-4. Estimated Corporate-Level Impacts Presented as Incremental Regulatory Costs as a Percent of Dye and Pigment Sales, High Sludge Generation Assumption 1/						
Small Company and Facility Location	Agency Preferred Approach 2/				Standard Listing Approach 2/	
	Low (Nonconditional mass-loading listing levels not exceeded) 3/		High (Nonconditional mass-loading listing levels exceeded for 1 facility) 3/			
	All Facilities Impacted	Only Known CoC Facilities Impacted	All Facilities Impacted	Only Known CoC Facilities Impacted	All Facilities Impacted	Only Known CoC Facilities Impacted
Abbey Color, Inc., Philadelphia, PA	0.01%	0.01%	0.01%	0.01%	0.40%	0.40%
AC&S, Incorporated, Nitro, WV	0.02%	0.00%	0.02%	0.00%	0.37%	0.00%
Apollo Colors, Rockdale, IL	0.02%	0.00%	0.02%	0.00%	0.50%	0.00%
Chemical Compounds, Inc., Newark, NJ	0.03%	0.00%	0.03%	0.00%	1.19%	0.00%
Dye Specialties*, Jersey City, NJ	0.00%	0.00%	0.00%	0.00%	0.02%	0.02%
European Color, PLC., Fall River, MA	0.03%	0.00%	0.03%	0.00%	0.65%	0.00%
Galaxie Chemical, Paterson, NJ	0.15%	0.00%	0.15%	0.00%	3.74%	0.00%
Industrial Color Company, Inc., Joliet, IL	0.03%	0.00%	0.03%	0.00%	0.66%	0.00%
TOTAL - Magruder Color Company	0.02%	0.00%	0.02%	0.00%	0.37%	0.00%
Max Marx Color, Irvington, NJ	0.03%	0.00%	0.03%	0.00%	0.68%	0.00%
Nation Ford Chemical Company, Fort Mill, SC	0.52%	0.53%	0.52%	0.53%	9.57%	9.57%
Passaic Color and Chemical (Royce Associates, LP), Paterson, NJ	0.01%	0.01%	0.29%	0.29%	0.29%	0.29%
Rose Color, Newark, NJ	0.02%	0.00%	0.02%	0.00%	0.54%	0.00%
Synalloy Corporation, Spartanburg, SC	0.02%	0.00%	0.02%	0.00%	0.17%	0.00%
United Color Manufacturing, Inc., Newton, PA	0.02%	0.00%	0.02%	0.00%	0.60%	0.00%
AVERAGE	0.06%	0.04%	0.08%	0.06%	1.32%	0.69%

1/ Nonwastewater generation rates based on the high generation rate assumptions described in Chapter 4.
2/ Both the Agency Preferred Approach and the Standard Listing include a most likely scenario, wherein impacts are projected only for four facilities with known constituents of concern in their nonwastewater. The worst case scenario assumes that in fact all facilities will generate nonwastewater with the constituents of concern.
3/ Impact estimates are presented for the Agency Preferred Approach using two assumptions regarding mass-loadings. The low impact estimates assume that the mass-loading listing levels are not exceeded. The high impact estimates assume that the mass-loading listing levels are exceeded by 1 facility.
* This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.

Table 5-5. Estimated Corporate-Level Impacts Presented as Incremental Regulatory Costs as a Percent of Dye and Pigment Sales, <u>Low</u> Sludge Generation Assumption 1/						
Small Company and Facility Location	**Agency Preferred Approach 2/**				**Standard Listing Approach 2/**	
	Low (Nonconditional mass-loading listing levels not exceeded) 3/		High (Nonconditional mass-loading listing levels exceeded for 1 facility) 3/			
	All Facilities Impacted	**Only Known CoC Facilities Impacted**	**All Facilities Impacted**	**Only Known CoC Facilities Impacted**	**All Facilities Impacted**	**Only Known CoC Facilities Impacted**
Abbey Color, Inc., Philadelphia, PA	0.01%	0.01%	0.01%	0.01%	0.16%	0.16%
AC&S, Incorporated, Nitro, WV	0.01%	0.00%	0.01%	0.00%	0.19%	0.00%
Apollo Colors, Rockdale, IL	0.01%	0.00%	0.01%	0.00%	0.16%	0.00%
Chemical Compounds, Inc., Newark, NJ	0.02%	0.00%	0.02%	0.00%	0.43%	0.00%
Dye Specialties*, Jersey City, NJ	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
European Color, PLC., Fall River, MA	0.01%	0.00%	0.01%	0.00%	0.21%	0.00%
Galaxie Chemical, Paterson, NJ	0.05%	0.00%	0.05%	0.00%	1.24%	0.00%
Industrial Color Company, Inc., Joliet, IL	0.01%	0.00%	0.01%	0.00%	0.24%	0.00%
TOTAL - Magruder Color Company	0.01%	0.00%	0.01%	0.00%	0.12%	0.00%
Max Marx Color, Irvington, NJ	0.01%	0.00%	0.01%	0.00%	0.24%	0.00%
Nation Ford Chemical Company, Fort Mill, SC	0.29%	0.29%	0.29%	0.29%	5.62%	5.62%
Passaic Color and Chemical (Royce Associates, LP), Paterson, NJ	0.00%	0.00%	0.10%	0.10%	0.10%	0.10%
Rose Color, Newark, NJ	0.01%	0.00%	0.01%	0.00%	0.20%	0.00%
Synalloy Corporation, Spartanburg, SC	0.02%	0.00%	0.02%	0.00%	0.07%	0.00%
United Color Manufacturing, Inc., Newton, PA	0.02%	0.00%	0.02%	0.00%	0.26%	0.00%
AVERAGE	0.03%	0.02%	0.04%	0.03%	0.62%	0.39%

1/ Nonwastewater generation rates based on the high generation rate assumptions described in Chapter 4.
2/ Both the Agency Preferred Approach and the Standard Listing include a most likely scenario, wherein impacts are projected only for four facilities with known constituents of concern in their nonwastewater. The worst case scenario assumes that in fact all facilities will generate nonwastewater with the constituents of concern.
3/ Impact estimates are presented for the Agency Preferred Approach using two assumptions regarding mass-loadings. The low impact estimates assume that the mass-loading listing levels are not exceeded. The high impact estimates assume that the mass-loading listing levels are exceeded by 1 facility.
* This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.

5.3 Other Impacts

As discussed in Chapter 4, the proposed waste listing may also result in impacts on land disposal facilities which have disposed of the wastes considered in this rulemaking. Because of the proposed listing, leachate from these landfills may be hazardous under the Derived-from Rule. Also, when the leachate from this waste mixes with leachate from other wastes disposed in these landfills the entire leachate quantity may be considered hazardous under the Mixture Rule. Accordingly there may be additional impacts on land disposal facilities from this proposed waste listing.

Cost impacts are expected to be less than those estimated in the proposed paint manufacturing hazardous waste listings given the dye, pigment, and FD&C industries generate less waste. For the proposed paint waste listings incremental costs expected to be incurred by the landfill industry were estimated to be approximately $300,000 to $400,000 annually for the Agency's proposed approach (which for leachate is the Clean Water Act Exemption with Two-Year Impoundment Replacement Deferral regulatory option).[72] However, the costs may be considerably lower as the result of possible savings gained through contract negotiations for repeat customers who provide consistent revenue streams to shipping companies through their regularly scheduled shipments of leachate. It also is likely that not all landfills that received dye, pigment and FD&C wastes prior to this proposed action have leachate collection systems which will lower the cost estimates.[73]

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72 EPA, *Economic Assessment for the Proposed Concentration-Based Listing of Wastewaters and Non-wastewaters from the Production of Paints and Coatings*, Docket Number: F-2001-PMLP-FFFFF, January 19, 2001.

73 Note: Leachate must be collected and pumped to be "generated," resulting in creation of the newly listed derived-from waste. Landfills without leachate collection systems are unable to "generate" this new waste.

6.0 SMALL BUSINESS IMPACT ANALYSIS

The Office of Solid Waste (OSW) is required to make an initial determination if any regulatory action may have a "significant economic impact on a substantial number of small entities." Small entities include small businesses, small organizations, and small governmental jurisdictions. OSW generally conducts a Regulatory Flexibility Screening Analysis (RFSA) to make this determination. The purpose of this chapter is to present the methodology and findings for the RFSA conducted in support of the proposed waste listing determination. This analysis was conducted per the requirements of the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

A series of questions regarding potential impacts of the proposed paint waste listing on small paint manufacturing entities must be answered in development of this analysis. These include:

1. Is the rule subject to SBREFA notice-and-comment rulemaking requirements?
2. What types of entities will be subject to the rule?
3. What types of small entities will be subject to the rule, if any?
4. Will small entities be adversely affected by the rule?
5. Will the rule have a significant economic impact on a substantial number of small entities?

6.1 Effects on Small Business

This section briefly outlines the types of entities affected. It also presents summary impacts data for all dye, pigment and FD&C colorant producers, and characterizes small entities according to size criteria set by the Small Business Administration (SBA)[74]. The number of small entities potentially affected are estimated. We also present estimated impacts under the alternative scenarios and options.

6.1.1 Type and Number of Entities Affected

The proposed listing could potentially affect an estimated 37 dye, pigment and FD&C colorant manufacturing facilities owned by 29 manufacturing companies. We have not identified any State, local or Tribal governmental entities (small or large) that own or operate dye, pigment and FD&C colorant manufacturing facilities.

We have found that 15 companies are estimated to be "small," based on the SBA definition of 750 or fewer employees at the corporate level. We have determined that dye, pigment and FD&C colorant manufacturing facilities are not owned or operated by small (or large) entities (not-for-profits, local governments, tribes, etc.), other than businesses.

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[74] *Table of Small Business Size Standards - Matched to North American Industrial Classification System (NAICS) Codes*, Revised May 5, 2003, U.S. Small Business Administration (SBA)

6.1.2 Economic Effect on Small Entities

We estimate that, under the proposed or Agency Preferred Approach, impacts on all 15 of the potentially impacted small dye and pigment businesses would average from 0.02 to 0.08 percent of annual gross revenues (Table 6-1). No company was found to experience annual compliance cost impacts greater than 0.53 percent of annual gross revenues.

We also examined potential economic impacts to small businesses under a Standard Listing Approach option. Impacts to small businesses under this option had average impacts ranging from 0.39 to 1.32 percent of annual gross corporate revenues. If all of the companies generate wastes with the constituents of concern, three may experience impacts in excess of 1.0 percent of sales, and two of these may experience impacts in excess of 3.0 percent of sales.

Some portion of these projected impacts may be expected to be passed on to consumers in the form of higher prices, while the remaining portion would be absorbed by the manufacturers.

TABLE 6-1. SUMMARY OF CORPORATE-LEVEL INCREMENTAL COST IMPACTS AS A PERCENT OF SALES FOR MANAGEMENT OF K181 WASTE				
Parameter		**Standard Listing Approach***	**Agency Preferred Approach***	
			Low (Nonconditional mass-loading listing levels not exceeded)	**High (Nonconditional mass-loading listing levels exceeded for 1 small facility)**
Most Likely Scenario: Only Including 4 Small Companies Identified Generating Wastes with Constituents of Concern				
Low Nonwastewater (K181) Generation Estimate	Range	0.00-5.62%	0.00-0.29%	0.00-0.29%
	Average	0.39%	0.02%	0.03%
High Nonwastewater (K181) Generation Estimate	Range	0.00-9.57%	0.00-0.53%	0.00-0.53%
	Average	0.69%	0.04%	0.06%
Worse Case Scenario: Including All 15 Small Companies				
Low Nonwastewater (K181) Generation Estimate	Range	0.00-5.62%	0.00-0.29%	0.00-0.29%
	Average	0.62%	0.03%	0.04%
High Nonwastewater (K181) Generation Estimate	Range	0.02-9.57%	0.00-0.53%	0.00-0.53%
	Average	1.32%	0.04%	0.08%

* Sampling and analytical costs only included for facilities generating greater than 1,000 metric tons of waste solids (K181) per year. Sampling and analysis conducted to determine if facility wastes are below the constituent-specific load-based risk standards. Facilities generating less than 1,000 metric tons per year are assumed to use operator knowledge of their processes to make this determination.
Source: See Chapter 4, 5.

6.1.3 Potential for Significant Impacts on Small Entities

The dye, pigment and FD&C colorant industries are split almost evenly between large and small entities. Accordingly it may be argued that there could be a substantial number of small entities impacted. However our analysis suggests that the impacts on these small entities are modest. Under the Agency's preferred regulatory option, no small facilities will experience impacts in excess of 1.0 percent of sales. Based on these findings, we do not believe that this rule, as proposed, will result in significant economic impacts on a substantial number of small business dye, pigment and FD&C colorant manufacturers.

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APPENDIX A

LIST OF POTENTIALLY IMPACTED DYE, PIGMENT AND FD&C FACILITIES

Table A-1. Final Facility List
U.S.-Based Dye, Pigment, and FD&C Colorant Manufacturing Facilities Believed to Generate Wastes of Concern*

Company Name	Facility Address	Facility Count	Waste Source		
			Pigment Manufacturing	Dye Manufacturing	FD&C Manufacturing
Abbey Color Incorporated [S]	400 East Tioga St. Philadelphia, PA 19134	1		x	
AC&S, Incorporated [S]	West 19th Street Par Industrial park Nitro, WV 25143	2		x[75]	
Apollo Colors [S]	1550 Mound Rd. Rockdale, IL 60436	3	x		
BASF Corporation	5th Ave, and 24th St. Huntington, WV 25722	4	x	x	
Bayer Corporation of US	Bushy Park Plant Dyes and Pigments Division P.O. Box 18088 Charleston, SC 29423	5	x	x	
Berwind Corporation (Common name in the U.S.: Colorcon)	415 Moyer Blvd. West Point, PA 19486	6			x

75 This facility is included based on information provided by ETAD relative only to dye manufacturing.

Table A-1. Final Facility List
U.S.-Based Dye, Pigment, and FD&C Colorant Manufacturing Facilities Believed to Generate Wastes of Concern*

Company Name	Facility Address	Facility Count	Waste Source: Pigment Manufacturing	Waste Source: Dye Manufacturing	Waste Source: FD&C Manufacturing
CDR Pigments and Dispersions (Owned by Flint Ink, Inc.)	410 Glendale-Milford Rd. Cincinnati, OH 45215	7	x		
	305 Ring St. Elizabethtown, KY 42701	8	x		
	471 Howard Ave. Holland, MI 49423	9	x		
Chemical Compounds, Incorporated [S]	29 Riverside Ave 75 Newark, NJ 07104	10			x
Ciba-Geigy (Ciba Specialty Chemicals)	4200 Geigy Access Rd. St. Gabriel, LA 70776-0749	11		x	
Clariant Corporation	500 and 500-A Washington St. Coventry, RI 02816	12	x		
	Highway 102 788 Chert Quarry Rd Martin, SC 29836	13		x	
Daicolor-Pope, Inc. (Owned by: Dainichiseika Color & Chemicals Mfg. Co.,Ltd., Japan)	33 Sixth Ave. Paterson, NJ 07524	14	x		

Table A-1. Final Facility List
U.S.-Based Dye, Pigment, and FD&C Colorant Manufacturing Facilities Believed to Generate Wastes of Concern*

Company Name	Facility Address	Facility Count	Waste Source		
			Pigment Manufacturing	Dye Manufacturing	FD&C Manufacturing
Dye Specialties [S] (This facility appears to have ceased operations in mid 2003. The future status of this facility is uncertain.)	P.O. Box 4130 407 Ege Ave. Jersey City, NJ 07304	15		x	
Eastman Chemical	P.O. Box 1974 Kingsport, TN 37662	16		x	
Engelhard Corporation	3400 Bank St. Louisville, KY 40212	17	x		
E.C. Pigments/European Color [S] (Common name in the U.S.: Roma Color)	749 Quequechan St. Fall River, MA 02723	18	x		
Galaxie Chemical [S]	26 Piercy Street Paterson, NJ 07544-0443	19	x		
Industrial Color Company, Inc. [S]	50 Industry Ave. Joliet, IL 60435	20	x		

Table A-1. Final Facility List
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Company Name	Facility Address	Facility Count	Waste Source		
			Pigment Manufacturing	Dye Manufacturing	FD&C Manufacturing
Lobeco Products, Incorporated[76] [Parent company is Nufarm Limited]	23 John Meeks Way Lobeco, SC 29931	21		x	
Magruder Color Company [S]	48 Leffert St. Carteret, NJ 07008	22	x		
	1029 Newark Ave. Elizabeth, NJ 07208-0498	23	x		
Max Marx Color [S]	1200 Grove St. Irvington, NJ 07111 or, 192 Coit Street Irvington, NJ 07111	24	x		
Nation Ford Chemical Company [S]	2300 Banks Street P.O. Box 997 Fort Mill, SC 29716	25		x	

76 This facility is included based on information provided by ETAD relative only to dye manufacturing.

Table A-1. Final Facility List
U.S.-Based Dye, Pigment, and FD&C Colorant Manufacturing Facilities Believed to Generate Wastes of Concern*

Company Name	Facility Address	Facility Count	Waste Source		
			Pigment Manufacturing	Dye Manufacturing	FD&C Manufacturing
Noveon, Incorporated (Noveon Hilton-Davis)	2235 Langdon Farm Rd. Cincinnati, OH 45237-4790	26	x	x	x
Passaic Color and Chemical (Royce Associates, LP) [S]	28-36 Paterson Street Paterson, NJ 07501	27		x	
Rose Color [S]	170 Blanchard Newark, NJ 07105	28		x	
Sensient Colors, Inc.	Baldwin Plant P.O. Box 14538 2526 Baldwin St. St. Louis, MO 63106	29		x	x
	16 Leliarts Lane Elmwood Park, NJ 07407	30		x	
	107 Wade Ave South Plainfield, NJ 07080	31			x

Table A-1. Final Facility List
U.S.-Based Dye, Pigment, and FD&C Colorant Manufacturing Facilities Believed to Generate Wastes of Concern*

Company Name	Facility Address	Facility Count	Waste Source		
			Pigment Manufacturing	Dye Manufacturing	FD&C Manufacturing
Sun Chemical Corp. (Most common name in the U.S. - The Colors Group) A wholly owned subsidiary of Dainippon Ink and Chemicals Incorporated (DIC) of Tokyo, Japan	441 Tompkins, Ave. Staten Island, NY 10305 (Rosebank, NY facility)	32	x		x
	4925 Evanston Ave. Muskegon, MI 49443	33	x		
	Facility location: 4526 Chickering Ave. Cincinnati, OH 45232	34	x		
Synalloy Corporation [S] (Blackman Uhler Chemical Co.)	P.O. Box 5627 2155 W. Croft Circle Spartanburg, SC 29304	35	x	x	
United Color Manufacturing, Inc. [S]	PO Box 480 Newtown, PA 18940	36		x	
Yorkshire Americas	P.O. Box 848 1602 Main St. Lowell, NC 28098	37		x	

Table A-1. Final Facility List U.S.-Based Dye, Pigment, and FD&C Colorant Manufacturing Facilities Believed to Generate Wastes of Concern*					
Company Name	Facility Address	Facility Count	Waste Source		
			Pigment Manufacturing	Dye Manufacturing	FD&C Manufacturing
	Total Number of Facilities =	37			
	Total Number of Companies =	29			
	Total Number of Small Companies =	15			